Electrical World

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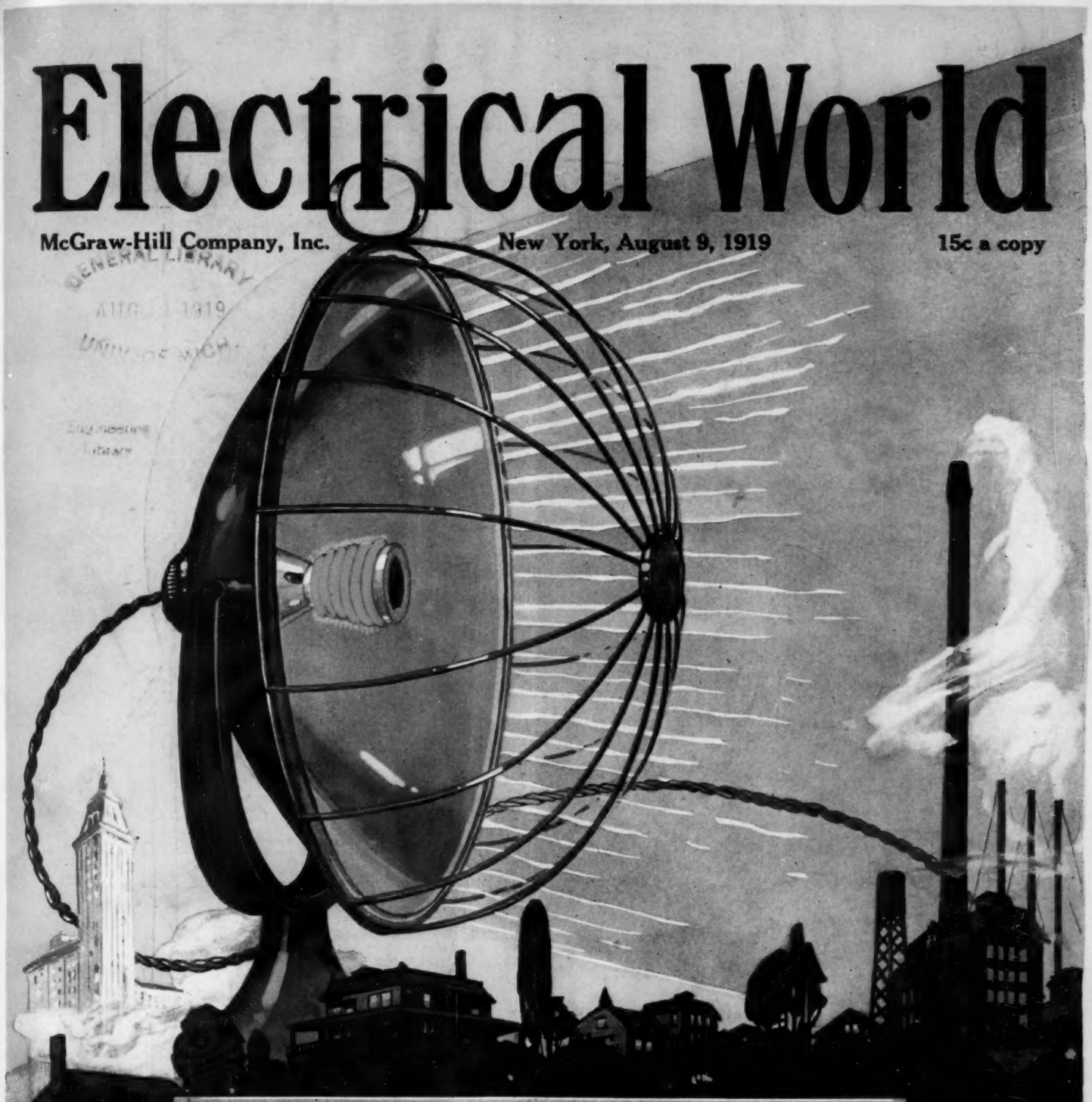

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Welfare of the Institute

SPEED is desirable in most things except where it is inimical to safety; then the time-worn but nevertheless excellent slogan of "Safety first" is applicable. It is becoming increasingly apparent that the development committee of the American Institute of Electrical Engineers was rather precipitate in its action at Lake Placid—too much so for the good of the profession, because few knew anything of what its report was about and fewer still grasped its full significance. This much is certain: confusion exists and this can be dispelled only by wide discussion and publicity. That something ought to be done to maintain the continued interest and support of the membership for the A. I. E. E. is admitted. How best to do it without sacrificing the honor, dignity and prestige of the Institute is a subject for discussion, and a wide-awake body would court all the opinions it could get, because on a subject so vital a multitude of counselors is none too many. For that reason the ELECTRICAL WORLD has opened its columns for a discussion of the plan, knowing that the ideas and information thereby obtained will be of value in reaching a satisfactory solution. Given time, the most constructive thought will be available. The report of the committee, excellent as it is, can lose nothing by reflection and study, whereas it may gain much.

Increased production lies at the bottom of every reasonable hope of stabilizing and then reducing the cost of living. In standardizing processes and equipment to this laudable end, electricity is the Aladdin lamp of industry. Wonderful opportunities are before electrical workers in face of the present economic emergency!

Value of Local Publicity

ALDERMEN, legislators and other authorities who represent the public in its dealings with public-service corporations fail for the most part to realize that utilities and the communities they serve are dependent upon each other for their growth and prosperity. This condition exists primarily because the ideas of the demagogue and somnambulist are more widely disseminated than the facts in the possession of the utility companies. The public cannot therefore be criticised for condemning what it does not understand nor blamed for decisions based on prejudiced and inaccurate information.

The public has invariably shown itself to be fair when properly informed, but frowns on sharp practices and is merciless to those who deviate from the path of rectitude. It does not as a rule demand something for nothing. In fact, good service at reasonable rates, based on a sane, broad-gaged policy, will usually win more good will than mere cheap service.

The interests of a utility are best protected by the development of executives who understand how to deal with the public and who can sense what the public requires in the way of service. It is well for a company to be animated by a policy that is fair and reasonable, but the public and its representatives should be apprised of the facts by means of proper publicity. Many attempts at publicity are abortive. Others lack sincerity and come to naught. No amount of publicity can right what is wrong, but good work should be made known. The good will of the public is an asset, and the central-station industry should give as much consideration to winning it as it does to the solution of its engineering and financial problems.

Electrical conveniences for the home vary tremendously in their earning power from energy sales, but this forms no excuse for underrating the value of such devices as washing machines and sewing-machine motors as "boosters" of central-station service. The sooner the public learns to think electrically the earlier it will be possible to reduce the cost of new-business getting.

Limiting the Exportation of Energy

THE advance of interconnection is accompanied in so many cases by indisputable economic benefits that it is impossible not to wonder how long a policy of prohibiting the exportation of energy from a given area or even from an entire state can withstand the impetus of the times toward interchanging resources. Opponents of exportation should realize that the trend of modern practice is toward coöperation no less than toward centralization. However successful a purely local development of hydroelectric or steam plant facilities may be, the latent possibility of utilizing them more effectively in connection with other systems ought always to be carefully considered.

Opponents of energy exportation assume to-day that their policy insures the maximum upbuilding of local communities centered about a stated power resource, preferably hydroelectric. They hold that cheap power available locally in large blocks will draw industries into such communities at the price of distance from raw materials, labor facilities and convenient markets; that the exportation of energy will slow down the growth of the state or area involved. Such claims are archaic. They ignore the irresistible trend of buyers toward the lowest-priced markets, all factors considered. The decision to locate a manufacturing plant in a given place may be reached as a result of low-cost power, but not necessarily by that alone. Transportation conditions

and facilities, the availability of raw material, labor, taxation laws and other things enter the problem.

In the long run society will buy at the minimum price, taking all feasible factors into account. If a combination of exported or interchanged energy and other economic conditions yields minimum cost of production, all charges included, at a point within electrical reach of the area now attempting to prohibit the shipment of energy across an artificial border line, it is useless to attempt to prohibit exportation, by and large. The benefits of interchange are so great when interconnection is handled with engineering and commercial skill that an attempt to maintain an electrical island in production within easy access of other efficient distributing or transmission systems seems ultimately doomed to failure. Useful coöperation rather than restricted isolation is the keynote of successful conservation.

It sounds like a happy succession of steps from manufacturer to jobber, central station and contractor-dealer. It is a fact, however, that all of these are dependent in the last analysis on the public, the great consumer. Let us help the people who are our customers to feel that they are a real part of the industry.

Loading Dissimilar Transformers

WHEN a balanced three-phase system is stepped down in pressure through three equal and similar single-phase transformers it is evident that, by symmetry, the balanced three-phase load will be equally divided between the three transformers. If, however, the three transformers are equal but dissimilar, they will not in general share the load equally. Thus the three single-phase transformers may each be correctly rated as of 100 kva., and yet when connected in delta to supply a balanced load of 300 kva. one may carry an undue share of the load and become overheated, just because the internal resistances and reactances of the transformers do not match. In order to keep this transformer bank from being overloaded in any part an extra transformer or bank of transformers must then be installed.

Every such bank of transformers is subject to definite arithmetical rules of load division. They do not admit of the treatment attributed in story to the stagecoach driver who, being informed when driving his team up hill that the progress was slow because only the gray mare was doing her proper share of the work, responded with the advice, "Whip up the gray mare." Any attempt to carry a load on an ill-assorted team of transformers by whipping up the gray mare is likely to mean that the gray mare will ultimately get burned out in the process.

The equivalent total resistance and reactance of a transformer are important constants of the apparatus that do not always receive the attention they deserve. It is well known that any single-phase transformer acts as a raiser or lowerer of voltage by virtually inserting a certain reactor into the circuit, without any voltage change. This equivalent reactor has a definite resistance and reactance. The share of load assumed by each member of a bank of transformers depends both on the resistance and on the reactance of the member in relation to the resistance and the reactance of the others. H. B. Dwight discussed this important matter very clearly last week in his article in relation to balanced loads.

Incidentally, it is interesting to notice that, although when six equal and symmetrical transformers are connected in delta to a balanced load and one of the six transformers has to be removed it might be supposed that the capacity of the bank had been reduced one-sixth, it has actually been reduced by two-sixths. The five remaining elements can only carry two-thirds of the original load without being overheated at the weakest point.

High lighting intensities in manufacturing plants benefit both employer and employee by increasing the output and by reducing the number of accidents. The industrial accidents in the United States which might have been prevented by proper illumination have cost enough to pay for all the industrial lighting of the country.

Switch-House Layout

SWITCHING facilities are one of the troublesome and unpleasant requirements of every station undertaking a considerable distribution. At first relatively simple, they grow in complication as the service is gradually built up, are usually extended according to a sort of symptomatic treatment, and finally the time arrives when for the sake of convenient and efficient service something radical has to be done. This was the situation that had arisen in Springfield, Mass., at the time when the installation which C. A. Corney describes this week was already somewhat overdue. The task which confronted the constructor was to install a new switching system, with a time limit for construction in order to take care of new equipment, consideration necessarily being given to future space requirements for other parts of the plant, to utilization of all available material to save cost, to convenience of situation with respect to present and future duct lines, and finally to insuring a change-over to reliable operation of the new switch house with the minimum risk and inconvenience. This involved a problem much more severe than the mere construction of a switch house for a new plant, and our readers will find much of interest in the details of the installation as actually carried out.

All clearances, disconnecting switches, insulating supports, current transformers and the like have been installed with reference to raising the voltage later from 5500 to 13,000 volts, and the extent of the switching requirements can be judged from the fact that there are forty-two oil circuit breakers connected to the power buses, each in a separate reinforced-concrete cell, and having sufficient capacity to handle any probable short circuit in the final development of the system There are, besides, twenty-eight lighting feeders, each equipped with an automatic single-phase potential regulator. Twenty-four 75-lamp mercury-arc rectifiers are installed on the switch-house floor for the street-lighting circuits, connected with a system of transfer buses for putting in spare rectifiers when necessary. In addition to these there are connections for a 66,000-volt supply system, and the entire equipment of transformers, all properly isolated, for handling the system now and, by the substitution of larger units, for some time in the future. The transformer banks and potential regulators for the high-voltage connection are in a separate transformer house, but remotely controlled from the switch room itself. A complete signal system between

the switchboard room and the turbine room and an auxiliary system between the boiler room and the tur bine room give unity in operation in spite of the isola tion of the several parts. The whole installation furnishes a capital instance of rapid and thorough reconstruction for a distribution system which had outgrown itself and required complete reorganizing of its auxiliaries.

Ye editor heard of one man who could not put up a dwelling because he was unable to find a builder to take the contract. The amount of construction necessary in dwelling houses, apartment buildings and hotels will be large until supply again overtakes demand. It means more wiring contracts, more customers for central-station service.

The Importance of Motor Testing

THE paper by Philip C. Jones on the testing of motors in industrial plants brings to the front some important economic considerations. One must remember that at the present time the cost of electrical equipment has risen very considerably above pre-war prices, and that the cost of energy, from whatever source derived, has also been tending upward. Therefore economy of motor equipment both in first cost and operating expense has to be considered on a fresh numerical basis. Of late years the tendency has been strongly toward individual drive, which for certain purposes has marked advantages. These advantages must now be weighed on a new balance between cost of drive and saving in output costs. The old figures will no longer do.

Mr. Jones particularly draws attention to the great difference in initial expense between large and small motors, a difference likely to be the more serious as the relative labor costs in motor manufacture increase. Beyond this one faces the ever-present question of motor rating with respect to load. In early motor practice not only were machines themselves usually rated very conservatively, but the user superadded extreme caution in estimating the load to be carried, the result often being that a 10-hp. motor perfectly capable of carrying 15 hp. under the actual working conditions of intermittent load was actually used at a maximum output of not over 5 hp. The result of this misfit was great increase in the first cost of equipment, lowered efficiency and lowered power factor. Underloading, of course, is specially pernicious when applied to individual motor drives where each unit operates independently and no advantage can be gained from the large diversity factor present in many cases of group driving.

There is nothing to be gained by underloading motors. It is, of course, necessary that a motor should not be put on a load which will stall it nor upon a continuous overload that will imperil its insulation. But motors are built and designed to carry their rated load, and the nearer this condition is fulfilled in every-day running the cheaper the installation, the less the cost of power and the better the power factor, which in not a few cases now enters very properly into the charge made for supply. It therefore behooves the engineers of industrial works to test out the load which is actually being applied to their motors so as to improve working conditions and to lower cost. Perhaps the real efficiency of the motor is nowadays the least important consideration, for as motors, and particularly induction motors, are now constructed the efficiency curve is pretty flat, so that beyond 50 or 60 per cent rating the variation in efficiency is not marked. The difference in cost of installation, however, between using a 5-hp. and a 10-hp. motor for a 5-hp. job is at once apparent. As to power factor, the case is different, particularly with the rather low-speed induction motors that are now common. As a rule the power factor is still steadily rising beyond full load, and at half load is uncomfortably low. This burdens the lines, requires additional standby expense all the way back to the prime movers at the station, increases the voltage loss, which in turn lowers the break-down point of the motor, and if it is taken into account in the schedule of rates, as it ought to be, increases the operating cost of the equipment. Mr. Jones does well, therefore, to lay stress on systematic testing of motor loads both with respect to steady use and to recurring cycles of operations which regularly vary the driven load. The process is neither difficult nor expensive and may readily pay for itself many times over. Central stations are often glad to coöperate with the consumer in obtaining the necessary data on motor drives, for no one more keenly feels the disadvantages of ill-planned equipment.

Which is worth more to society, "minding the train" or "training the mind"? Motormen receiving three times the hourly wage of college instructors symptomize an intellectual astigmatism on the part of the public which, if neglected long enough, will produce economic blindness and disaster to progress.

Speculating on the Rate of Return

AMONG the unanswered questions which follow in the wake of the war is that of the rate of return on capital in electric public utilities. Before the war there was evidence of a drift to the conclusion that 8 per cent should be allowed on the capital investment in established properties of this character. This rate was approved frequently in cases before public service commissions, and in many respects it was fully equitable. If calculated roughly on the investment as represented by outstanding stock and bond capitalization, it provided for the bond interest, an acceptable rate of dividend on the stock, and perhaps a little margin for reserve or for exigencies in operation. Of course, a mere percentage rate of return does not assure this safe outcome unless capitalization is regarded as synonymous with plant value. To determine the amount of the return it is necessary first to determine the amount of capital on which the approved rate of return is to be authorized. During the war some commissions substituted a policy in determining value for rate-making purposes which expedited cases and made a vital saving in time over the old method of detailed appraisal. Their policy then was not so much to check each item of property and value as to afford relief promptly where the burden of heavier operating costs was becoming unbearable. Commissions are still facing the factor of abnormal cost conditions. Under these circumstances will they return to the labored, expensive method of valuation which antedated the war or will they accept the present situation as one that still demands extraordinary treatment, departure from precedents?

High-Voltage Laboratory at Purdue University

Design and Layout of Equipment Which Will Permit Investigation and Testing with Potentials Up to 600,000 Volts—Control of Voltages in Primary Makes Possible 100 per Cent Variation in 480 Steps

BY C. FRANCIS HARDING
Head School of Electrical Engineering, Purdue University

PURDUE UNIVERSITY has been engaged in extra-high-voltage research investigations and tests for the past ten years. The present equipment, consisting of a 30-kva., 220/250,000-volt step-up transformer, was reconstructed in 1909 from parts of the so-called million-volt transformer exhibited at the St. Louis Exposition. This apparatus, although not of modern design, has given very effective results, particularly in corona loss investigations on transmission lines. The results of these tests*, which checked very closely with those made at Schenectady, N. Y.†, under quite different conditions, pointed to the conclusion that at voltages above 150,000 the empirical formula developed by F. W. Peek, Jr., for corona loss may be subject to error. In order that this law might be further investigated and other research work carried on, particulaly in connection with fixation of atmospheric nitrogen at extra high voltages, an extensive addition to present equipment has been planned.

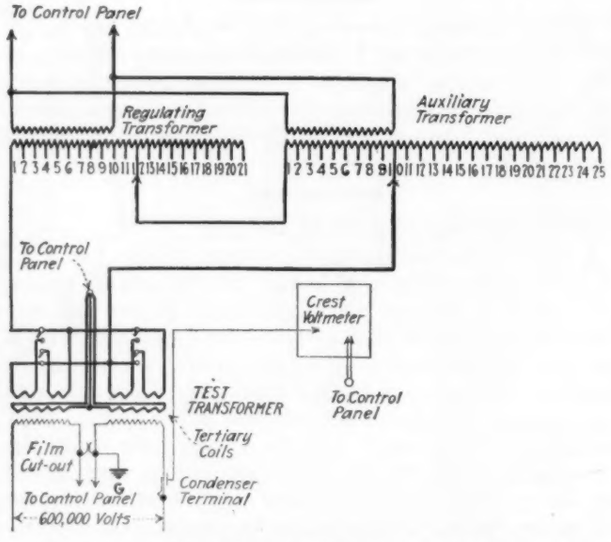


FIG. 1—STEP-BY-STEP VOLTAGE CONTROL IN PRIMARY CIRCUIT

TWO 300,000-VOLT TRANSFORMERS MAY BE CONNECTED IN SERIES FOR 600,000 VOLTS

A contract has been placed with the Westinghouse Electric & Manufacturing Company for two single-phase 135-kva., 300,000-volt, 60-cycle oil-insulated transformers, each with provision for one secondary terminal being grounded to the case. The other secondary terminal is provided with a condenser-type bushing. One of these bushings provides charging current for a crest voltmeter. The two transformers may be connected in series on the secondary side in order to provide 600,000 volts between buses.

In order that the power and current delivered by the secondary may be measured, provision has been made for the insertion of a portable ammeter and the current coil of a wattmeter between one of the secondary leads and ground by means of an ammeter jack on the switchboard. A film cut-out connected across the ammeter leads offers protection from high voltage in case this circuit should be accidentally opened. The potential coil of the wattmeter and a portable voltmeter may be connected to a tertiary coil so located in the transformer as to supply a voltage proportional to that of the secondary.

Two prime features are necessary for the successful control of extra-high-voltage testing circuits. First, the voltage must be varied by very small increments over the entire range of the transformer; second, the wave form must not be distorted by the control apparatus. These requirements are met quite satisfactorily at present by means of a water rheostat control in the 220-volt circuit. This method is cumbersome, however, and even dangerous when controlling large-capacity transformers with high-voltage primaries and was, therefore, left out of consideration when planning the new equipment.

Three possible types of control remained—the induction regulator, the motor-generator set with variable field control, and the step-by-step variable ratio auxiliary transformer. The induction regulator introduces wave distortions which are particularly objectionable with the loads of leading power factor usually encountered in extra-high-voltage testing. The motor-generator set offers a marked advantage in distributing a single-phase testing load equally over the various phases of a polyphase supply, but it has the disadvantages of high first cost, low efficiency and limited range of variation with unequal increments. Even with combined generator and exciter field control, the effect of the magnetization curves of both exciter and generator is sure to be reflected in variable increments of voltage for different steps of the field rheostat. Even if a satisfactory adjustment of rheostat resistance steps should be provided for one load, another load, especially one of radically different power factor, would cause quite a different voltage variation.

OPERATION OF VOLTAGE-CONTROL SCHEME

The step-by-step auxiliary transformer control, although somewhat complicated in its connections between transformer and controller, was finally adopted as best fitted to the demands upon the testing transformer. The objection often brought against this type of control to the effect that it involves too large fixed steps of voltage variation is very ingeniously overcome in the design of this controller. A regulating transformer is provided with twenty secondary taps sup-

*See paper by C. Francis Harding, "Corona Losses Between Wires at High Voltages," *Transactions A. I. E. E.*, 1912, Vol. XXXI, page 1035.

†See paper by F. W. Peek, Jr., *Transactions A. I. E. E.*, 1911, Vol. XXX, page 1889; also Vol. XXXIV, page 274.

plying a corresponding number of voltages to the primary of the testing transformer. Each of these voltages may be further subdivided into twenty-four steps by the floating secondary coil of an auxiliary transformer with twenty-four taps. In other words, the latter coil acts as a twenty-four-division vernier which may be connected at will between the taps of the larger transformer, thereby supplying a total of 480 equal increments of voltage to the primary of the testing transformer. This arrangement will be readily understood from Fig.1. The proper sequence of connections is maintained by means of two control drums connected by means of a 24 to 1 gear ratio. After the twenty-four taps of the auxiliary transformer have been used to subdivide the first coil on the regulating transformer, the second drum of the controller steps up the auxiliary transformer to the second coil of the regulating transformer, etc. Thus the entire range of the testing transformer may be covered by means of steps of one-fifth of 1 per cent.

In order to add further to the flexibility of control without excessive complication, provision is made by means of disconnecting switches for operating the two sections of the primary winding of the testing transformers either in series or parallel, for low and high voltage ranges respectively. One transformer only will be used for tests not exceeding 300,000 volts, while both units, with primary coils in parallel, will be connected in series for the higher potentials.

It will be noted from the plan view of the new laboratory in Fig. 2 that provision is being made for a third similar transformer to be installed in the future to provide for three-phase investigations with Y-connected units up to 300,000 volts per phase or 520,000 volts between lines.

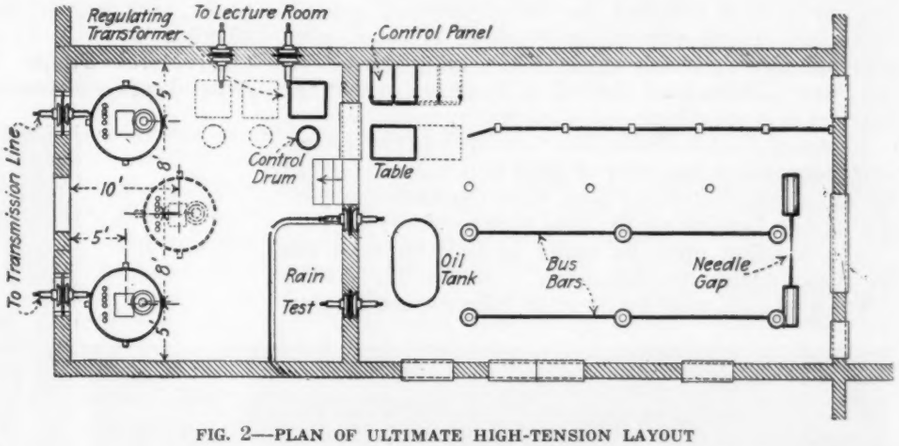


FIG. 2—PLAN OF ULTIMATE HIGH-TENSION LAYOUT

The present high-voltage laboratory is being extended approximately 25 ft. (7.6 m.), the extension being provided with a concrete floor depressed sufficiently to provide the necessary head room for the new transformers, which measure 15 ft. 4 in. (4.7 m.), from floor to top of high-tension terminal. Although the controller and auxiliary control transformers are located in the transformer room, remote control is provided from the main switchboard at the higher level, from which the operation of the equipment may be readily watched. Interlocking circuits connected with the gates leading to the control balcony provide protection for the operators and cause danger signals to be displayed when the circuits are closed.

The experimental high-voltage transmission line, with which corona losses have been studied for several years, will be connected to the terminals of the new transformers through wall bushings. Similar bushings provide high-voltage service to the lecture room and the present high-voltage testing laboratory.

PROVISION IS MADE FOR INSULATOR TESTS

The laboratory is being provided with an oil tank immediately under the high-voltage buses for insulation tests. In addition, a rain test for line insulators is being installed in the transformer room. Needle, sphere and horn-gap phenomena may be very conveniently and safely exhibited at the further end of the laboratory, where large plate-glass windows separate the audience from all high-voltage circuits.

With the completion of this high-voltage apparatus and laboratory in the early fall, Purdue University will be equipped with excellent facilities for extra-high-voltage testing, instruction and research work.

COMMITTEE IS ORGANIZED FOR POWER-FACTOR STUDY

Special Joint Committee of A. I. E. E. and N. E. L. A. on Determination of Power Factor in Polyphase Circuits

Announcement has been made in the *N. E. L. A. Bulletin* of the appointment of a committee, to be known as the special joint committee on determination of power factor in polyphase circuits. The present personnel of the committee is as follows: R. J. McClelland, chairman; S. G. Rhodes, secretary; Dr. A. E. Kennelly, Dr. P. G. Agnew, F. P. Cox, P. MacGahan and R. F. Schuchardt. The committee may later be expanded to represent other committees or organizations.

The primary purpose of the committee is to establish a definition for power factor in polyphase circuits which shall be universally applicable to all polyphase circuits, whether balanced or unbalanced, and which shall satisfactorily take into account the various considerations involved in the commercial and technical uses of the term and in devising methods and instruments for its measurement. The question of defining power factor in polyphase circuits has long been the subject of discussion by those interested in the generation, distribution and sale of electrical energy. It is now becoming of increasingly great practical importance, owing to the pronounced tendency to include power factor as one of the specific factors determining the rates at which electrical power shall be sold.

The committee is taking steps to collect all available scientific and technical data bearing upon the subject, and it requests all those who are interested in it or have data which may aid in its study to communicate. The committee will welcome suggestions relating to any of the phases of the subject, and particularly illustrations where the application of authoritative definitions or measurements will be helpful at the present time.

Layout of Modern Switch House

Special Consideration Given to Future Requirements, Safety of Operators, Continuity of Service, Economy of Materials, and Relation to Rest of Generating Station

BY C. A. CORNEY
Stone & Webster

SAFE and logical additions to the United Electric Light Company's light and power switching facilities had become so difficult before the armistice was signed, owing to space limitations, and the equipment, once suitable, had become so inadequate for the increasingly severe service requirements imposed by large additions in generating equipment and loads, that the company was forced to consider immediate means of providing better facilities.

Prompt action was compelled because the existing arrangements threatened continuity of service to many war inductries which were absorbing more than 50 per cent of the total power output of the company. Patriotic duty and service to the public further emphasized the need, so that, notwithstanding the prevailing high labor and material costs, a thoroughly modern switching installation designed for many years of growth was planned and erected by Stone & Webster, who, although already widely engaged in serving war activities, were able to meet the call of the management for services in a consulting and constructing capacity.

Choice of Switch-House Location.—The following factors, arranged in the order of their importance as gaged by the necessities of the case, were considered as governing the location of the new switch house:

The building must be ready in time to meet the promised equipment deliveries.

Consideration must be given to future space requirements of the boiler rooms, turbine room, switch house, coal-handling machinery and coal storage.

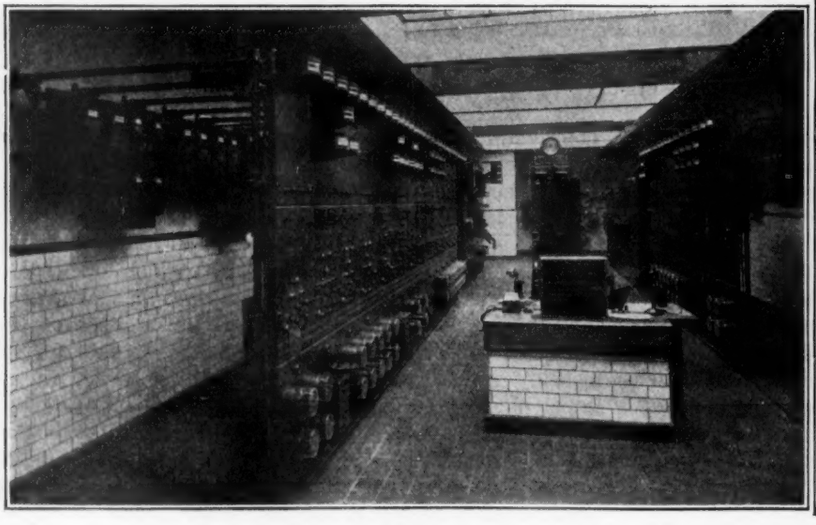
There must be a minimum of inconvenience to customers and to the public, of risk in station operation and of disturbance to present structures.

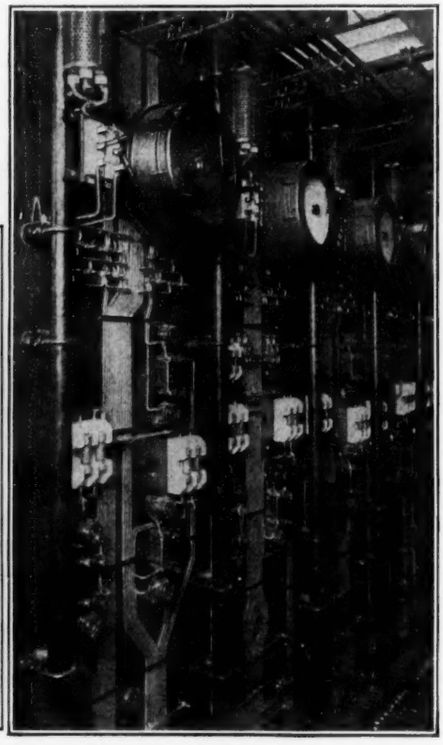
Economy in structural cost and utilization of the existing investment must be well considered.

The physical relation of the switch house to generating equipment and to distributing duct lines must play an important part in the final decision.

At the time that the choice was being made the company was shutting down an old boiler plant in favor of a new and larger plant just reaching completion, this making available a boiler-house building adjoining the turbine room on the east. After careful study this was found to possess a maximum number of advantages as a switch house, so it was decided to renovate the place, although the difficulty of designing interior arrangements to meet existing exterior walls and roof were appreciated. Extreme care was necessary in design to maintain clearances and prevent congestion, as is evidenced by the fact that only 2400 cu.ft. (67.3 cu.m.) of building volume is allotted to each outgoing feeder, including arc-lamp circuits, and that more than 20 miles (32 km.) of conduit was installed.

Structural Design Features.—The usual type of switch-house construction, that of steel framing, was abandoned in this case in favor of a wholly reinforced-concrete construction. Thus the high cost and the uncertainties in delivery and erection of structural-steel framing were eliminated at once. The layout and placing of conduit, although difficult at best owing to the large number of circuits to be served in a limited space, was much simplified by not having to dodge steel framing





FIGS. 1 AND 2—SWITCHBOARD ROOM LIGHTED FROM GLASS CEILING; BACK OF BOARD WIRING

at every turn. This construction also made possible the liberal use of inserts for mounting insulated supports and disconnecting switches.

The structure for inclosing the power buses, potential transformers and disconnecting switches is constructed with vertical phase barriers of 3-in. (7.6-cm.) hollow tile reinforced internally with steel and cement tile dado is used for side walls up to a height of 4½ ft. (1.4 m.). Low-hanging roof trusses were encountered, which were concealed by building into them a false beamed ceiling, as shown in Fig. 1. Between beams are pivoted steel sashes containing factory-ribbed glass. About 3 ft. (0.9 m.) above this false ceiling are skylights which admit daylight to the switchboard room. Illumi-

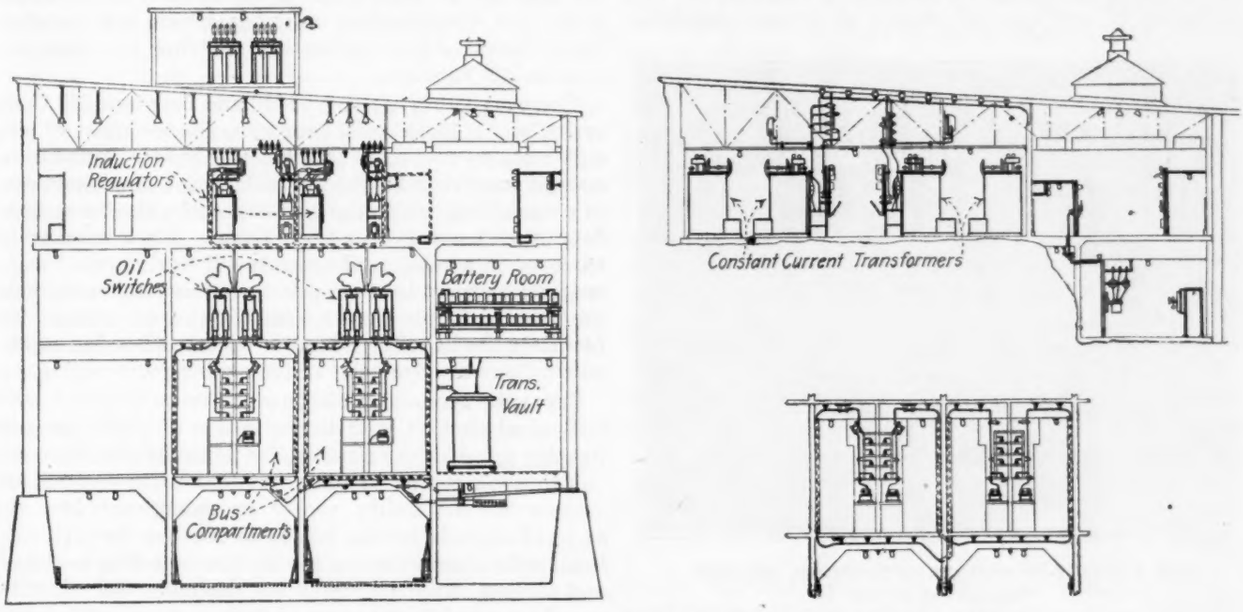


FIG. 3—CROSS-SECTION OF SWITCH HOUSE WITH SECTION THROUGH OTHER PHASES

and plastered outside to a width of 4 in. (10.2 cm.). The longitudinal phase barriers surrounding each individuol bus are pre-cast concrete slabs as are also the horizontal sections of the potential-transformer compartments. The upper dividing wall between east and west buses is of brick, while that lower down between transformer compartments is of concrete cast in place. The

nation at night is derived from lighting fixtures placed between the ceiling and skylight. The effect is a very pleasing and well-lighted room at all times. Window openings are provided so that operators may look directly into the turbine room, but all former window openings in the exterior walls are bricked up to exclude railway dust and cinders.

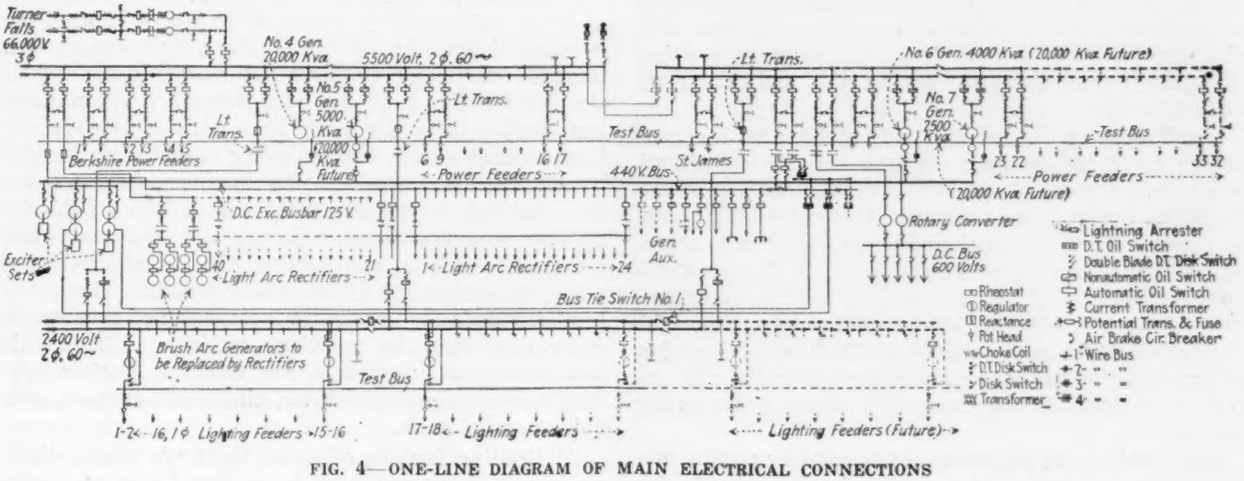


FIG. 4—ONE-LINE DIAGRAM OF MAIN ELECTRICAL CONNECTIONS

use of hollow tile for vertical barriers, instead of the usual concrete or brick, is estimated to have saved approximately 30 per cent of the total cost of a similar structure using concrete throughout. At the same time construction was considerably speeded up and no appreciable sacrifice was made in structural strength.

The architectural features of the switchboard room received particular attention. Red tile in 6-in. (15-cm.) squares is used as a floor finish, while a brick-size white-

Electrical Design Features—The physical arrangement of electrical equipment is clearly shown by the cross-sections, Fig. 3, while the main electrical connections are shown by the one-line diagram, Fig. 4. As may be seen, all circuit breakers serving the 5500-volt power buses have been entirely isolated from them by being placed on the floor above, and further, east and west buses and east and west circuit breakers have in turn been isolated from each other by means of partition

walls. The 2400-volt lighting buses and associated equipment, mercury-arc rectifiers and their equipment, switchboards, station auxiliary apparatus, station battery, lighting transformer tanks and outgoing cable and potheads also occupy separate and distinct portions of the building and are separated from each other by partition walls in which are standard fire doors. It may also be noted that considerable space is available for the extension of any type of service at present supplied.

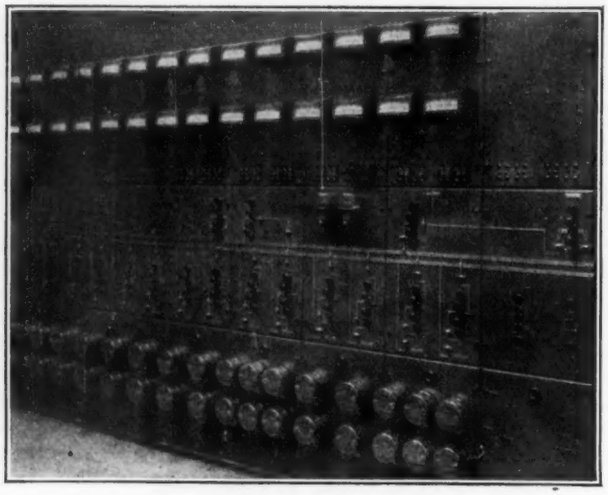


FIG. 5—CLOSE-UP VIEW OF SWITCHBOARD, SHOWING MINIATURE BUSES

Some of the equipment shown, such as rectifiers, feeder potential regulators, etc., was taken from the old station and installed in the new.

The 5500-volt, two-phase power buses each consist of three 3-in. by ¼-in. (7.6-cm. by 6.4-mm.) copper bars per phase mounted flatwise on 15,000-volt supports which are equipped with spring clamps to allow for expansion and contraction of the copper. Each bus is anchored at its mid-point, thus limiting expansion or contraction at any point along its length relative to the bus structure. Anchorage of the bus is accomplished by simply removing the springs from clamps at these points and setting up bolts securely.

The buses are divided into four sections with a generator connected to each through selector oil circuit breakers. Connected with the first section are two 9360-kva. banks of transformers through which power is received from or supplied to two 66,000-volt, three-phase lines of the Turners Falls Power & Electric Company's system. To this section are further connected two tie lines which run to the United Electric Light Company's water-power station No. 2. The third section of bus likewise has connected to it two tie lines to the United Electric Light Company's other water-power station, No. 3.

Each section can at present be isolated by section disconnecting switches, and provision has been made for the future installation of oil circuit breakers for isolating sections 1 and 2 from 3 and 4. From each section with the exception of the last a circuit is taken off through selector oil circuit breakers to a bank of lighting transformers which step the voltage down to 2400 volts and supply lighting buses.

To permit boosting the voltage to 13,000 volts at some later time, clearances have been provided for this voltage, and all equipment such as disconnecting switches, current transformers, insulated supports, etc., with the exception of potential transformers, has been insulated for this voltage. Higher-voltage oil-insulated potential transformers can be easily accommodated when it is necessary to replace the present air-insulated transformers. To drain voltage surges off the main buses electrolytic arresters are employed. Asbestos lumber doors are provided to inclose the potential transformers and shield the disconnecting switches which are installed below them. All disconnecting switches are equipped with safety catches.

There are thirty-eight type H6 and four type H3 General Electric 15,000-volt, four-pole, single-throw oil circuit breakers connected to the power buses. These have enough rupturing ability to handle safely any short-circuit conditions which the contemplated ultimate system development can impose upon them. Each breaker is mounted in a reinforced-concrete cell, having reinforced-concrete barriers between poles, and the breaker tie rods are secured to the floor by embedded steel plates. To facilitate the handling of motor-operated breaker mechanism there are eye bolts in the switch-room ceiling.

From the connection diagram it can be observed that individual circuits, with the exception of generator and lighting transformer circuits, are normally fed from one bus through one oil breaker, but that when desired for reasons of inspection, repair or emergency two associated circuits can be fed from one bus through one breaker by simply closing the tie disconnecting switches and cutting out the breaker not desired. All circuits may be treated in this way if desired, thus cutting one bus out of service. This twin arrangement of circuit breakers makes for great economy of building space and gives many of the advantages of a complete selector arrangement with a considerable saving in equipment cost. The arrangement involves the use of separate metering and tripping current transformers and necessitates having each of the breakers of sufficient capacity to handle twice its normal load.

The 2400-volt, two-phase lighting buses are composed of main and auxiliary buses. Each phase of each bus consists of two 3-in. by ¼-in. (7.6-cm. by 6.4-mm.) bars mounted vertically on 7500-volt supports secured to the bottom chord of the roof trusses. These buses are divided into three sections with a transformer bank feeding each. The main bus sections are isolated by oil breakers, whereas the auxiliary bus sections are isolated by disconnecting switches. Likewise between the transformer banks and the main sections and breakers, and between the transformers and auxiliary sections are disconnecting switches. Provision has been made for the future installation of breakers in connection with the auxiliary sections. The bus-tie and transformer breakers are General Electric type K-12B four-pole, single-throw, single-pole-element, solenoid-operated units.

All lighting feeders, of which there are twenty-eight, are single-phase and each is equipped with a single-phase, full-automatic feeder potential regulator. Each regulator is mounted on small T-rails to facilitate removal for repairs. Two lighting feeders are fed through one four-pole, single-throw, solenoid-operated feeder breaker energized from the main buses. Transformer banks and feeders can be thrown on to the auxiliary bus when necessary for purposes of repairing or cleaning the main buses, breakers or regulators by means of disconnecting switches. Electrolytic arresters,

mounted in a housing in the roof, act as dischargers for the main lighting buses only.

Three two-phase lighting transformer banks are installed, separate compartments being provided on the bus floor for each bank. The compartments now housing the smaller banks are of sufficient size and properly equipped to take 7500-kva. banks in the future. The switching equipment of the smaller banks is also of suitable rating to permit the future installation of a 75,000-kva. bank. The ordinary rails and turntable or transfer truck and depressed rails are done away with, and inverted channel irons are embedded in the floor to guide the transformer wheels when it is desired to roll the transformers out into the turbine room under the crane for repairs or inspection. These wheels are pivoted in the transformer base like casters so that when the direction of motion is to be changed they need only be turned in their sockets. This is done by jacking up the transformer sufficiently to take the weight from one wheel at a time. Each transformer has an alarm contact thermometer to indicate excessive temperature rise.

Twenty-four double-tube, 75-lamp mercury-arc rectifiers are installed on the switchboard floor to serve the street-lighting circuits. To facilitate replacing faulty rectifiers a system of transfer buses (also used as test buses) is arranged in connection with a transfer board so that any one of four spare rectifiers can be substituted for any rectifier in any one of eight groups which will eventually be installed. Prompt starting is assured by arrangements for heating the oil in which rectifier tubes are immersed. On each rectifier are small auxiliary switches to operate an annunciator and sound an alarm in the switchboard room if the rectifier shuts down.

Normally river water is used for cooling the transformers and in emergencies for cooling rectifiers, while city water is used for normal rectifier supply and for emergency transformer cooling. Transformer and rectifier return piping is carried to an open-flow indicator in the switchboard room directly under the control valves. Supply to individual transformers and groups of rectifiers is regulated by valves in the return piping. Transformer cooling-coil drains are provided at the transformers.

Oil piping provides means of draining the transformer oil into storage tanks. Filter-press connections are made so that the oil can be dried and filtered by being circulated directly from the transformer or from the storage tanks. Oil drain valves are equipped to be operated from the adjoining bus room so that transformers can be drained without having to enter the compartments.

Energy for exciting the generators is normally furnished from an excitation bus, but throw-over switches are mounted on pedestals in the switchboard room that connect the generator fields to direct-connected exciters in emergencies.

The motors driving the separate exciters can be started on half-voltage transformer taps from a station service board and are fed from a 400-kva. bank of 5500/440-volt exciter transformers whose load can be taken up temporarily by a 300-kva. bank of station service transformers in case of trouble. Likewise the exciter transformers are available for feeding station-service circuits when necessary. The station-control storage battery can be charged from the exciter bus when occasion demands, and the station emergency lighting system can also be energized from the exciter bus. A voltage regulator is provided to keep station voltage constant. This does not operate when the direct-connected exciters are being used.

The transformer banks and potential regulator feeding lines of the Turners Falls system are located in a separate transformer house and are remote-controlled through a duct line from the switchboard room. From this transformer house alarm circuits connected with water-flow indicators and contact thermometers run to the switchboard room.

Switchboard and panel arrangements are such as to follow wherever possible the order of physical arrangement of apparatus in the building. This, together with a very complete mimic bus, conduces to ease and simplicity in operation. The two 5500-volt boards are arranged facing each other, which brings generator panels opposite and allows an operator to control and watch these circuits to advantage. A pedestal for mounting station voltmeters and synchroscope and for future control of bus section switches is between the north ends of the 5500-volt switchboards. Watt-hour meters are located on auxiliary panels back of the main panels and wiring is carried to them through the switchboard back-brace pipes.

Each set of disconnecting switches associated with the 5500-volt bus is represented in the mimic bus by a mimic disconnecting switch, which is provided at the back of the panel with a special rotary switch arranged to turn on and off a small signal light at the disconnecting switches themselves. Thus an operator can by this means indicate from the switchboard just which particular set of disconnecting switches he wants opened or closed. As a further safety device to prevent opening

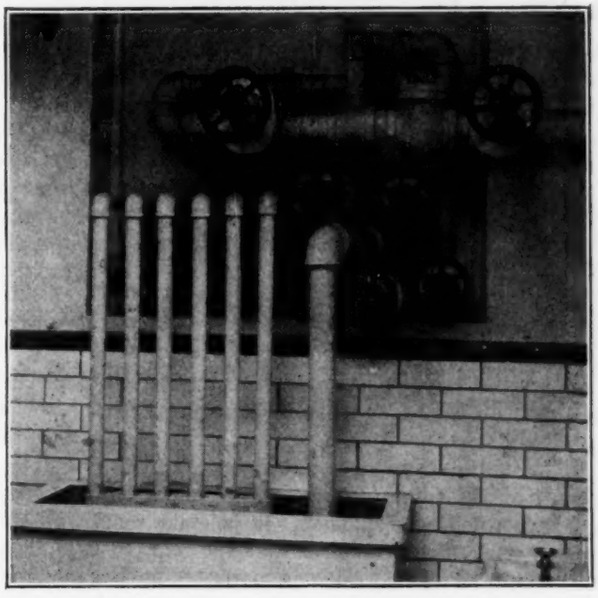


FIG. 6—COOLING-WATER PIPES FROM TRANSFORMERS

a disconnecting switch under load, there is located at the switches which isolate an oil breaker a set of red and green bull's-eye signal lamps which are in multiple with those at the control switch on the panel and indicate to an operator the condition of the breaker.

For signaling between switchboard room and turbine room a system has been installed whereby the desired signal is displayed on a large illuminated sign in the turbine room at the switchboard panel concerned, and on a

signal pedestal at the machine concerned. By one operation on the part of the operator information is automatically given as to which generator or exciter is involved and the exact operation to be performed. The system is an adaptation of the standard General Electric signal system. Between boiler room and turbine room is another illuminated sign on which the station load in kilowatts can be indicated by the operation of a load bulletin control panel in the switchboard room.

Feeder and transformer circuits are protected by induction-type overload relays, while tie lines, including circuits to Turners Falls, have balanced relay protection. The usual bell alarms indicating the opening of oil breakers are provided, those on the 2400-volt board being so wired as to indicate on which of a pair of single-phase lighting feeders trouble has occurred.

Energy for station power service is provided by a 300-kva., 5500/440-volt, two-phase, three-wire bank of transformers. The circuits are controlled from the switchboard room by means of remote-controlled hand-operated oil circuit breakers. Station lighting is taken care of by two 50-kva. transformers fed from the 440-volt station service bus. The emergency lights are normally fed from these transformers, but in case of trouble are automatically switched to the station control battery and in the event that this source fails can be thrown onto the exciter bus.

Energy for control circuits is furnished by sixty Electric Storage Battery Company's type E-11 cells rated at 200 amp.-hr. The battery is charged from a 10-kw. motor-generator set.

Communication is afforded by twelve Western Electric auto-phones installed on all floors of the switch house and in other parts of the plant.

In the cable rooms and 2400-volt bus rooms a test bus consisting of one 2-in. by ¼-in. (5-cm. by 6.4-mm.) copper bar on insulated supports has been installed; test sticks facilitate the testing and location of cable faults.

R. W. Day is president of the United Electric Light Company, W. L. Mulligan is manager, and J. P. McKearin is electrical engineer of the United Electric Light Company, Springfield, Mass.

Testing Instrument Transformers for Polarity

Method of Testing Current Transformers Resembling That Quite Commonly Used for Potential Transformers — Polarity of Instrument Transformers Should Be Checked Before Connecting Them in the Circuit

BY CLIFFORD W. BATES, E. E.
Philadelphia Electric Company

SOME confusion and uncertainty exists among electrical engineers and others regarding the meaning of the polarity of instrument transformers, especially in the case of current transformers. Tests of the polarity of current transformers may be made in a manner quite similar to those of potential transformers. In this discussion, then, potential transformer tests are first given and the explanation of current transformer tests readily follows. Polarity tests should always precede the installation of instrument transformers on account of the possibility that tags have been disarranged. This might happen, for instance, during repair.

Explanation of Term Polarity

Suppose that a wattmeter is connected into circuit as shown in Fig. 1, so as to indicate properly the power used, giving a positive deflection. Now let a "one-to-one" potential transformer be inserted in the potential circuit of the wattmeter in such a way as still to give a positive deflection. Then the polarity marks on the transformer should be such that the marked secondary terminal of the transformer is connected to that terminal of the wattmeter which was formerly connected to the side of the line now connected to the marked primary terminal. Fig. 2 shows this change as well as the similar insertion of a current transformer.

Now when an alternating voltage is impressed on the primary coil of a transformer, a voltage is induced in each coil of the transformer, primary as well as secondary. In the case of the secondary coil it is this voltage which tends to force current through the secondary circuit, but in the primary coil this voltage opposes the impressed voltage and is nearly equal to it, being merely enough smaller than the impressed voltage to allow the primary current to flow in the direction of the impressed voltage. Then if, as shown in Fig 2, the impressed voltage is momentarily in the direction from A to B through the transformer, an induced voltage exists which is in the direction from B to A. Terminal B may be connected to X with the result that the induced voltages will add, giving a larger voltage from A to Y than exists across either A and B or X and Y.

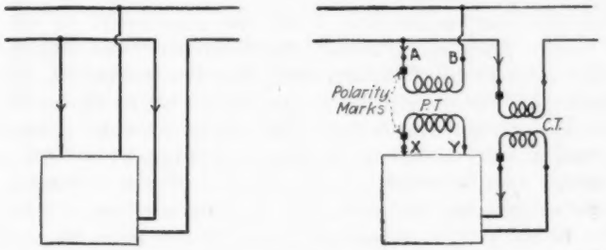
The most convenient method of determining or checking the polarity of potential transformers depends on this principle. Assume that the polarity marking of the primary terminals has been lost, due possibly to repairs having been made on the transformer. Connect the marked secondary terminal to one primary terminal and impress a safe voltage (from a 110-volt or 220-volt alternating current source) to the high-voltage terminals of the transformer. A small voltage will be induced in the low-voltage coil which will add to or subtract from the applied voltage. If the voltage measured across both coils is larger than the applied voltage, the marked secondary terminal has been connected to the primary terminal, which should not be marked.

Checking Polarity of Current Transformers

Passing now to current transformers, suppose that a "one-to-one" current transformer is connected as shown in Fig. 2 into the current circuit of the wattmeter of Fig. 1, in such a way that the deflection remains positive. Then the polarity marks of the current transformer should be located in a manner exactly similar to those on the potential transformer. That is, the marked secondary terminal of the transformer should be connected to the wattmeter terminal

which was formerly connected to the line wire that is now connected to the marked primary terminal.

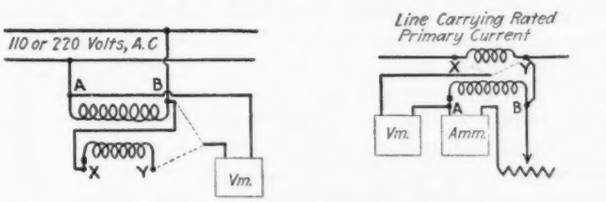
The method of determining current transformer polarity which is given here is one which is very easily applied during the usual routine of determining the ratio of the transformer. Since abuse of the transformer in any way (such as the passage of an extreme overload due to a line short-circuit, passage of direct



FIGS. 1 AND 2—WATTMETER CONNECTED INTO CIRCUIT (1) WITHOUT AND (2) WITH INSTRUMENT TRANSFORMERS.

current or opening the secondary circuit of the transformer under load) may "magnetize" the transformer, that is, affect the magnetic characteristics in such a way as to change the ratio by an amount which may be appreciable for some purposes (use with watt-hour meters principally), current transformers should always be demagnetized before the ratio test is made. For this purpose a 10-to-25-ohm slide-wire rheostat capable of carrying the full-load secondary current of the transformer is connected across its secondary terminals. While full-load current is passed in the primary circuit the resistance in the secondary circuit is gradually reduced to zero.

The polarity of the transformer may be checked at the same time by practically the method already described for potential transformers. The connections are shown in Fig. 4. The voltmeter should preferably have a 30-volt to 75-volt range, but a 150-volt instrument may be used. As before, the marked terminal of one coil is connected to one of the terminals of the other coil. The voltmeter is connected across the secondary terminals of the transformer and the slide-wire rheostat is adjusted so as to obtain a large deflection on the voltmeter. The voltage will rise to this large value on account of the tendency



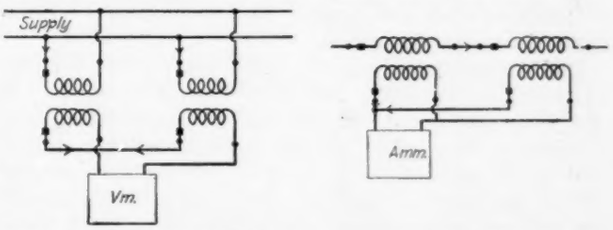
FIGS. 3 AND 4—CONNECTIONS FOR DETERMINING POLARITY OF (3) POTENTIAL TRANSFORMER AND (4) CURRENT TRANSFORMER.

of the transformer to be self-regulating, or, in other words, the voltage will rise in the attempt to send normal secondary current through the secondary circuit. Any voltage below the open-circuit value (which varies from 80 volts to 500 volts at rated primary current, depending on the type of traneformer) may be obtained. Care should be exercised to prevent damaging a low-range instrument by starting with low resistance in the secondary. The voltage across the primary terminals will also rise approximately to the value corresponding to the ratio of transformation. This voltage, which is smaller than the secondary voltage, will be added algebraically to that across the secondary terminals. The test for polarity is exactly the same as before. If the voltage across both coils is larger than that across the secondary coil, the marked terminal of one coil has been connected to the terminal of the other, which should have no mark.

If many transformers of either type are to be tested for polarity, it will be found a great convenience to provide a pair of voltmeter leads with snap terminals at one end and a single jumper lead with snap terminals at both ends for connecting the coils together.

Other Methods of Determining Polarity

There are other methods of testing polarity, but that given here will be found much simpler in its application than any other. Among these other methods may be mentioned the test made by a wattmeter as used for illustration at the beginning of this article and a direct-current method involving the ballistic kick occurring in a millivoltmeter connected across one coil when a direct current is established in the other. The first of these methods is clumsy, and if the ratio of the transformer under test is large, will involve considerable difficulty due to the very great difference in the deflections obtained. The direct-current method should not be used with current transformers on account of the danger of



FIGS. 5 AND 6—COMPARISON METHOD OF TESTING (5) POTENTIAL TRANSFORMERS AND (6) CURRENT TRANSFORMERS.

"magnetizing" them, and in the case of potential transformers it has no advantage over the method described.

It is occasionally convenient, however, to use a comparison method if a transformer of known polarity and the same nominal ratio is available or if it is desired to determine whether all transformers of a group have similar polarity. To test potential transformers in this way the high-voltage windings should be connected in parallel to a suitable supply, the terminals which are supposed to have the same polarity being connected together. A low-voltage terminal of one transformer is connected to a low-voltage terminal of the other and the remaining terminals of the transformers are connected to a voltmeter whose range is at least double the voltage delivered by one of the low-voltage coils at the primary voltage applied. These connections are shown in Fig. 5. If like terminals have been connected together throughout, the voltmeter will read practically zero, but if the relative polarity is not the same, double voltage will be obtained. In the corresponding method applied to current transformers the primary coils are connected in series in a line carrying a suitable current and the secondary coils are connected in parallel to an ammeter capable of carrying double the secondary current of one transformer, as shown in Fig. 6. If the polarities of the transformers are as indicated in the figure, double current will be read on the ammeter.

Underfeed Stokers Permit Advances in Design

Introduction of Forced Draft in Connection with Changes in Stoker and Furnace Design Make Possible 620 per Cent Boiler Rating

BY H. A. LYNETTE*
Westinghous Electric & Manufacturing Company

IT HAS been long known among boiler and stoker engineers that no danger need be feared in "driving" a well-designed boiler up to the limit of the coal-burning capacity of the stoker. But the problem of getting higher ratings out of equipment has been to develop stokers which will be able to meet the more severe requirements. From the outset it was apparent that the natural draft of the highest chimneys would be inadequate to burn enough coal per square foot of grate surface to drive the boilers at the rate required to produce extraordinarily high ratings. About 40 lb. to 45 lb. of coal per square foot (195 kg. to 220 kg. per sq. m.) of grate surface per hour is the maximum combustion rate which can be attained with any natural-draft stoker. The size of the grate surface, of course, is limited by the size of the boiler, and consequently no relief could be had from that source. The forced-draft multiple-retort underfeed stoker appeared, however, and was found to possess coal-burning capacity running up to 80 lb. per square foot (390 kg. per sq. m.) of grate surface per hour. This development stimulated boiler-room progress.

Improvements in design of boiler and stoker combinations during the last four years have been great. A few years ago about 200 per cent of boiler rating was considered the limit. In the modern central station to-day it is no uncommon thing to find boilers operated at 300 per cent or 400 per cent rating continuously, and much higher ratings are developed on peak loads of a few hours' duration.

For instance, one of the boilers at the Buffalo General Electric Company's generating station having a rating of 1140 hp. was operated recently at 620 per cent rating for eight hours without damage to the boiler or stoker. At this rating the boiler was evaporating over 200,000 lb. (90,000 kg.) of water per hour, while the stoker was burning over 10 tons of coal per hour. This unit was designed to operate twenty-four hours per day at 480 per cent of its rated capacity. It is possible to take one of these boilers with a banked fire and to reach 200 per cent rating within six minutes from the time the stoker is put in operation.

The first multiple-retort underfeed stokers were installed with much the same general type of boiler setting as had been the practice with other types of stokers in use. It was found, however, by experience in actual operation that some changes in setting, design and methods of application were desirable. High rates of combustion required larger combustion chambers than formerly, and intense fuel-bed temperature made it advisable to place the actual heating surface exposed to radiant heat further from the fuel bed in order to avoid the danger of blistering the tubes. At the same time it became apparent that anything in the way of arches or encircling tile which might interfere with the absorption of heat by radiation from the fuel bed was unnecessary from the standpoint of aiding combustion and undesirable from the standpoint of efficiency. Such construction interfered with the absorption of heat by radiation and placed a burden on the boiler of heat absorption by convection which the boiler could not efficiently carry. The reason for this is clear when it is remembered that heat absorption by radiation varies approximately as the square of the difference in temperature between the heating surface of the boiler and the radiation surface of the fuel beds, whereas heat absorption by convection is in direct proportion to the difference in temperatures between the heating surface of the boiler and the temperature of the gases. It is thus seen that it is extremely advantageous so to arrange the boiler and stoker combination so as to permit as large a part as possible of the heat to be absorbed by direct radiation from the fuel bed. The hot gases thus enter the actual tube region at a much lower temperature and the temperature of the gases leaving the boiler is lower in proportion. Owing to the intense fuel-bed temperature, it is desirable not only to eliminate arches and encircling tiles on the tubes but to eliminate any other boiler brickwork possible in the furnace region, thus reducing the amount of brickwork and maintenance. Double stokering the boiler and thus eliminating entirely the bridge wall has been one of the greatest advances. Two things are thus accomplished. The bridge-wall brickwork is done away with and the double stoker so increases the amount of grate surface possible under the boiler that very much higher capacity may be developed without forcing the stokers to abnormal combustion rates.

One of the greatest fields of usefulness for the multiple-retort underfeed stoker lies in meeting the increased steam requirements of the existing plants. A typical case will probably illustrate this. A small utility plant was built eight years ago, at which time the peak load was 1800 kw. Four 500-hp. boilers were installed, of which three, operating at about 125 per cent rating, were sufficient to carry the load. After five years, the load had increased to 2200 kw., making it necessary to force three boilers to the limit of their capacity, about 165 per cent rating. The company then had an opportunity to take on a new customer using 800 kw. To carry this increase would require two additional boilers and stokers. This extra equipment would necessitate considerable extension to the boiler house. The total cost would have amounted to about $90,000.

Instead of doing this, the four old stokers under the boilers were replaced by multiple-retort underfeed stokers, designed to operate the boilers continuously at 250 per cent rating and to meet peak loads of 300 per cent for four-hour periods. The total available boiler output of the four boilers thus became 5000 hp. continuously and 6000 hp. for four-hour periods. The total cost of changing to underfeed equipment was approximately $30,000. The over-all efficiency with the new stokers being considerably higher than was possible with the old ones, the fuel cost was reduced. The revamped plant also had greater flexibility than before.

*From a paper presented before the Nebraska Section, N. E. L. A., at Grand Island.

Motor Testing in Industrial Plants

More Attention Should Be Given the Problem of Selecting Motors of Correct Size to Offset Their Increased Cost—Essential Data Are Accumulated by Systematic Testing, and Serious Losses Are Curtailed

BY PHILIP CHAPIN JONES
Electrical Engineer Goodrich Tire & Rubber Company, Akron, Ohio

THE use of electric motors in industrial plants has increased enormously in recent years, and the present tendency is toward a still greater increase. In large plants the use of two or three horsepower in motors per man employed is common. Man is becoming a directing power, not a laboring one. Not only are motors becoming more numerous, however, but they are becoming smaller. Individual drive is replacing group drive. It was formerly common for a plant to have a few large motors driving practically all the machinery in the plant. Now the same plant will have

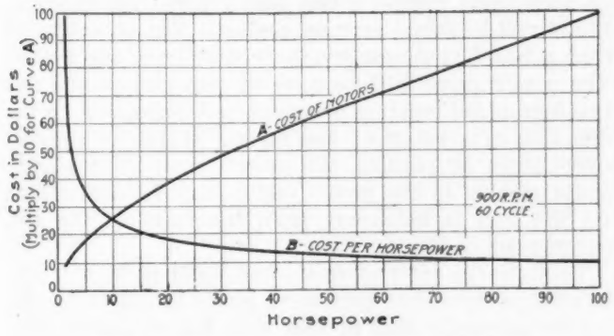


FIG. 1—AVERAGE COST OF MOTORS IN 1919

dozens of motors for each one previously possessed, each motor driving its own machine.

The proper selection of motor size will do much to offset the high investment in a large number of motors at present costs. But the intelligent choice of motors may only be made when enough data are available concerning the loads to be carried. Careful testing and accumulation of the data will insure correct loading of motors, and a discussion of the use of indicating and recording instruments for this work should be useful.

In order to visualize the cost of motors consider that a 10-hp. direct-current motor will cost as much as a Ford automobile. Even a 0.5-hp. induction motor, the cheapest thing possible in motors, will cost well over $50. Thus with the increase in use of motors the capital investment per man becomes large, probably averaging around $40 per man for motors only. The tendency toward individual drive increases this tendency. From Fig. 1 it will be noted that a 1-hp. motor costs about $100 per horsepower, while a 100-hp. motor costs a little less than $10 per horsepower. Thus a plant with 1000 hp. in large motors may have an investment of $10 per horsepower, while a plant with 1000 hp. in small motors will have perhaps ten times as great an investment.

There is still another factor resulting from individual drive which tends to increase the investment in motors. The diversity factor is to a large extent eliminated. With one large motor driving a line shaft, the horsepower rating of the motor need not be anywhere near the combined horsepower requirements of the connected load, while with individual drive the motor horsepower and the machine horsepower are approximately the same.

PROPER SELECTION OF MOTORS CHECKS THE RISING COST OF MOTOR DRIVE

With all these factors tending to increase the cost of motor drive and thus forcing up prices all along the line, it is left to the engineer to exert a counter pressure to bring down these costs. This may be done only by properly selecting each motor for its load so that in all cases the maximum work will be obtained from each motor. This evident demand for the efficient application of motors is sufficiently warranted by their high cost, but original cost is not the only factor involved. Setting aside the original cost, motors not properly fitted to their loads will prove a great operating expense, even though the cost of energy per horsepower-hour is low. This unwarranted expense in the operation of motors is due to low efficiency and low power factor of underloaded motors.

In general, the variation of efficiency is of less importance than the power factor, although the loss caused by low efficiency is directly evident and easily computed. This is due to the fact that the curve of efficiency and load is much flatter than the power-factor curve, and that above half load there is no considerable increase in efficiency. This may be seen from Fig. 2. For the

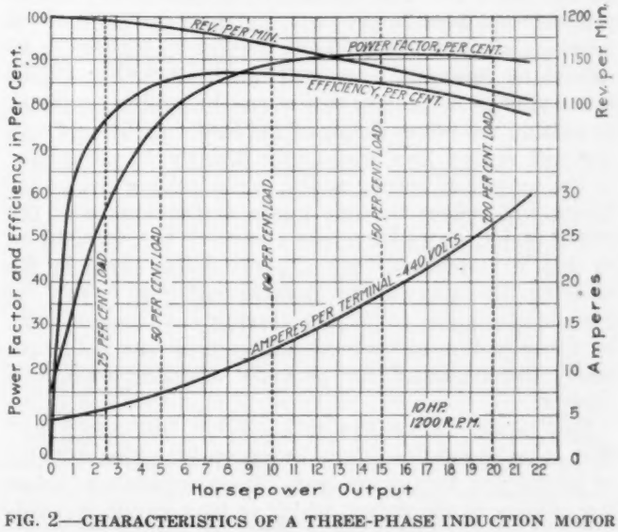


FIG. 2—CHARACTERISTICS OF A THREE-PHASE INDUCTION MOTOR
10 hp., 440 volts, 60 cycles, 1200 r.p.m.

particular motor to which these curves apply the efficiencies at 50 per cent and 150 per cent load are equal, and at no point in between does the efficiency go more than 2 per cent above this value. Therefore unless the motor is very badly underloaded the efficiency will be of minor importance only.

The effect of low power factor is not only more serious but more ramified and elusive. It has three

branches—influence (1) on generator capacity, (2) on line losses and (3) on regulation. A generator is rated in kilovolt-amperes, not in kilowatts, and thus a 10,000-kva. machine will carry 10,000 kw. at unity power factor, 8000 kw. at 80 per cent power factor and only 5000 kw. at 50 per cent power factor. Thus, if the

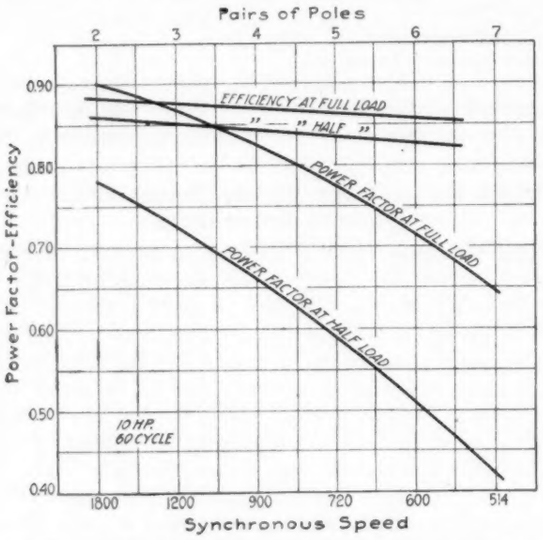


FIG. 3—EFFECT OF SPEED ON MOTOR CHARACTERISTICS
10-hp., 60-cycle, three-phase induction motor

power factor is low, generating capacity may cost just double what it should.

Line losses vary with the square of the current, and as the current varies inversely with the power factor the line losses vary inversely as the square of the power factor. If, for instance, the line loss at 100 per cent power factor is 100 kw., at 50 per cent power factor the line loss becomes 400 kw. Of course, in percentage of energy used the line losses are comparatively small, probably not over 10 per cent; but in large plants with demands upward of 10,000 kw. the line losses become an important item and are well worth reducing. Line losses may be reduced in two ways—by adding copper or by raising the power factor of the load. Additional copper will reduce line losses only directly in proportion to the weight of copper added, while raising the power factor will reduce the line losses as the square of the power factor, as we have seen above. When, in addition to this, it is realized that of every dollar saved by increasing the copper a considerable part goes to pay for the added copper, while in bettering the power factor by using motors of correct size, nothing but gains are made, the argument for properly selecting motors is evident.

Low power factor has still another bad effect, and that is on regulation. The line drop increases directly in proportion to the current. Poor regulation means low voltage at the motor, which in turn entails burned-out motors and motors that will not carry their loads. The torque an induction motor can develop is proportional to the square of the impressed voltage. With a 25 per cent voltage drop the maximum torque will drop 44 per cent, and the motor will simply fail to carry loads that it ought to. The motor current increases in proportion to the drop in voltage, so that with low voltage motors will burn out while carrying loads that would be entirely safe at rated voltage.

With all these increased expenses both in original investment and in operation directly traceable to oversized motors, it becomes evident that the proper fitting of a motor to its load is of vital importance to the economy of plant operation. There is only one means of getting motors properly fitted to their loads and keeping them so, and that is systematic and intelligent motor testing. It probably yields better returns on money invested than any other improvement, and in addition to this the necessary equipment for testing is not at all expensive.

The testing equipment which may be advantageously used is varied and will depend on size of plant and general types of drives. It will undoubtedly be increased once the management realizes the savings to be made. The simplest outfit which should be employed, assuming three-phase energy, is a voltmeter, an ammeter, one single-phase wattmeter and a current transformer. Very satisfactory voltmeters and ammeters may be obtained at less than $30 each. The transformer should have a selective range of ratios. Five, ten and twenty to one are satisfactory for most purposes. To go with these meters a test board wired as shown in Fig. 4 will be found very convenient. The operation of such a board is simple and is evident from the sketch. The power input will be read on two phases and the readings added together or subtracted, depending on the direction of reading of the meter. There is a great convenience in reading the power input with single-phase meters as the power factor may be determined (if the load is balanced) from the ratio of the two meter readings.*

To make the most of motor testing it must not only be used to determine whether a motor is the right size for its particular load at that time but to gather data on power requirements of the various machines used in

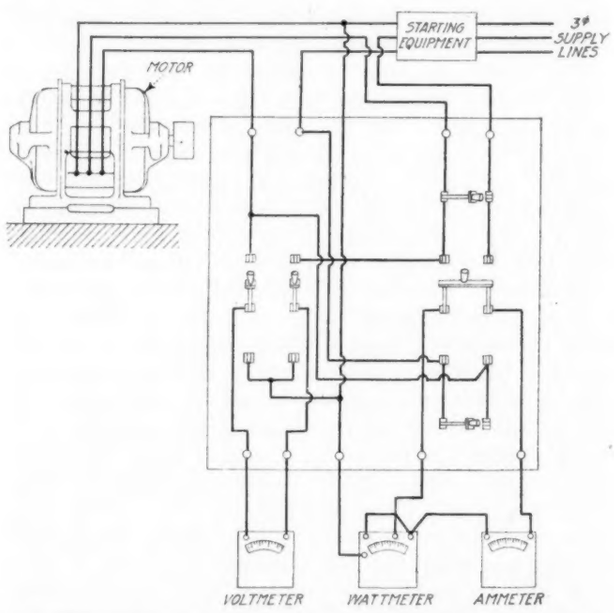


FIG. 4—CONVENIENT TESTING BOARD FOR THREE-PHASE MOTORS

the plant, so that future drives may from the start be equipped with motors of proper size. This latter is really the main use of motor testing, for in this way the results of tests are cumulative. Stress has been laid on "intelligent and systematic testing"—no other kind

*See ELECTRICAL WORLD, page 1220, Dec. 28, 1918.

can begin to bring out the full advantages of the work.

Necessarily a test is of comparatively short duration, and very rarely can one obtain during the short test period all conditions that might exist at the machine. As an example with which all plants are more or less familiar, consider a metal lathe. It is not likely that

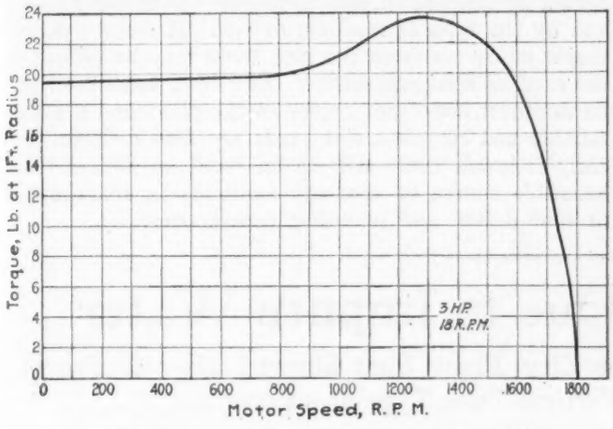


FIG. 5—TORQUE-SPEED CHARACTERISTICS OF AN INDUCTION MOTOR
3 hp., 1800 r.p.m., 440 volts

during one test period all combinations of material, depth of cut, speed, etc., can be obtained. But if advantage is taken of what variety is obtainable and a few trials made to determine the effect on the load of the depth of cut, speed and hardness of material, information will then be on hand which, when plotted, will yield quite reliable data as to load under all possible conditions. The tester will then be in a position to say not only whether the motor in question is the correct size for the particular conditions under which he made his test, but whether it is rightly proportioned considering all possible operations of the lathe.

EFFECT OF INTERMITTENT LOAD ON MOTOR SIZE

One thing which must be given careful consideration in motor testing is load factor, or the ratio of the average load on the motor during its operating period—eight, sixteen or twenty-four hours as the case may be—to its maximum load. This receives far too little attention in most motor drives. The rating of an induction motor, or of almost any motor for that matter, is only a very rough standard by which to judge it. There is no definite meaning attached to it, and it should be used relatively only; that is, to distinguish it in relative capacity from a motor of different rating. The three factors which really determine the working ability of the motor are temperature rise, breakdown torque and efficiency. As testing is used mainly to assist in the proper loading of a motor, the bearing of these three factors on the motor load cannot well be overlooked.

The temperature which a motor will attain is a balance between two factors, the rate of heating and the rate of cooling. The rate of heating is directly proportional to the square of the current, the rate of cooling to the temperature of the room and certain factors of the motor design. In general, however, the factor that exercises the prepotent influence is the square of current, and, roughly speaking, the temperature to which a motor will rise is directly proportional to the square of the current times the length of time it flows. Thus as far as heating is concerned the horsepower rating of a motor means little unless connected with a time. A 5-hp. motor may easily carry a 10-hp. load without the slightest harm to itself, provided that the time is not too long.

The second factor governing the possible load on a motor is breakdown torque. An induction motor, unlike some other styles, has a definite breakdown torque which is greater than its starting torque, and if this torque is exceeded the motor will come to rest. A torque curve for a three-phase induction motor is shown in Fig. 5. It will be noted that from synchronous speed to maximum torque the curve is nearly a straight line. Along this line the motor will operate satisfactorily, but once the crest of the curve is passed the motor will come to rest.

The third factor, efficiency, may be typically represented by Fig. 2. From half load to 150 per cent load the curve is quite flat, so efficiency does not become of any vital importance except for very lightly loaded or very heavily overloaded motors.

Keeping these facts in mind, the problem of motor testing is to determine the load-time cycle of a certain drive and the maximum power it will require at any instant. Then, knowing the temperature constants of various-size motors and their maximum torques, a motor having a minimum first cost and a maximum average power factor and efficiency over its duty cycle must be fitted to the load.

TAKING MEASUREMENTS WITH FLUCTUATING LOADS

To determine these factors, the simple equipment mentioned before, if used carefully and intelligently and supplemented by a stop watch, will serve. But, as time is so important an element, some form of measuring instrument which includes this time element is extremely valuable. This may be graphic meter or a rotating standard. (An ordinary watt-hour meter may also be used with some success.) The graphic meter has now come into quite common use and its value is evident. The rotating standard is not used as yet to

MOTOR TEST CARD No.

Motor 40 Size H.P. Machines

Location: Bldg. Floor Dept. Chart No.

Drive: Type Pulley size Speed Reduction

Line Volts								Watts Input	Load Conditions
									Numbers of Instruments Used Scales Used.

FIG. 6—SAMPLE CARD FOR KEEPING TEST DATA
On reverse side of card is space for drive data, nature of load, approximate diversity factor, etc., and finally signature and date.

any great extent, but its use should be encouraged as it has some points of superiority to a graphic meter. With a rotating standard on a varying load, readings may be taken at very short intervals, every thirty seconds or even less often if necessary, and thus a curve may be obtained which is practically as good as a

graphic meter would provide and the additional advantages of increased accuracy and an integration of the power may be obtained. With a rotating standard the average loads may be determined accurately for very short periods at the same time the load is being determined for a complete duty cycle. These are advantages that will be appreciated the more the rotating standard is used.

After making motor tests and determining the important factors—average load, maximum load and the causes of the loads—the next step is to record the results. Probably as good a plan as any is to employ for this purpose 5-in. by 8-in. (12.5-cm. by 8-cm.) cards numbered serially, which can be filed and indexed. The arrangement of the card will depend on the conditions and the preferences of the man in charge of the work. The one shown herewith is a good example. The essential things are date, name of tester, number of motor, data as complete as possible on the machines driven, and then the test data with full notations as to just what the load was at each reading. These motor-test cards should be indexed in two ways—by the motor number and by the type of machine driven. If there are any charts or curves from the test, these may be pinned to the card or filed separately. Once tests have been run on the most important drives in the plant and a set of reliable and complete test cards are filed and conveniently indexed, there will be on hand an almost inexhaustible source of economy available in rearranging present drives and planning future ones.

Curing Boiler Trouble Due to Impure Water

An Analysis of Experiments Made in a Kansas City Plant That Showed How to Prevent Priming in Water-Tube Boilers of Vertical-Tube Type at an Average Cost of $645 per Boiler

BY J. N. HELPBRINGER
Superintendent of Plants Kansas Gas & Electric Company

THERE has always been some prejudice among certain engineers against the vertical-tube or Stirling-type water-tube boiler on account of its tendency to prime when using water containing a large number of grains of solids, and especially when the water is high in sodium salts. This trouble confronted a large manufacturing company in the Middle West a few years ago when it was faced with the problem of operating 9000 hp. of boilers of this type on water which carried 50 to 75 grains of salt per gallon (0.8 to 1.3 gm. per liter), as well as a large amount of solids. During the first year after the plant was installed very little trouble was encountered, but as the boilers came to be operated at higher ratings the priming became very serious, and especially so since the sodium content of the boiler water increased from 20 grains per gallon (0.3 gm. per liter) to 70 grains per gallon (1.1 gm. per liter), owing to a large salt-manufacturing company allowing its brine refuse to contaminate the supply. Priming was particularly troublesome because of the fact that the manufacturing company used a large percentage of the steam for a delicate manufacturing process. The boiler manufacturer was finally asked to furnish an engineer to work in conjunction with the plant superintendent in an endeavor to find some remedy.

As a first step along this line the boiler was equipped with recording flow meters on both the steam and feed lines. A recording steam calorimeter, made by introducing the bulb of a very sensitive recording thermometer into the well of a standard throttling calorimeter, was used to record the moisture. Incidentally this was found to be a great aid in solving the problem. A recording pressure gage and a recording thermometer were installed on the steam line just after it left the boiler. A recording draft gage was connected to the air box of the underfeed stoker. The blow-off line was tapped just ahead of the blow-off valve and a small cock installed in order that frequent samples of the water might be taken for analysis.

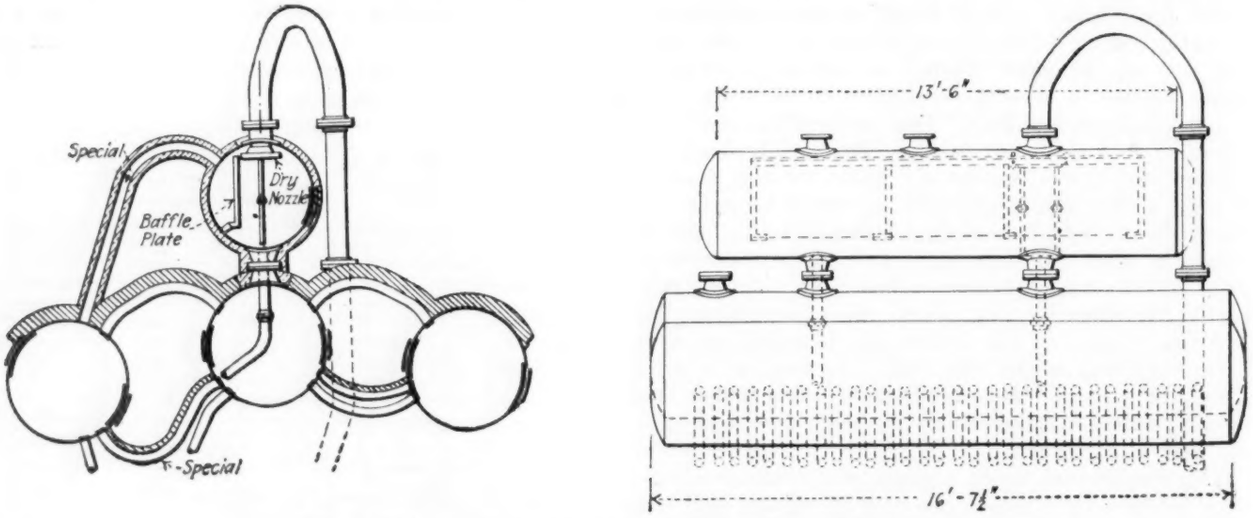


FIG. 1—MODIFICATIONS IN BOILERS WHICH PREVENTED PRIMING

WHAT CAUSED THE TROUBLE

A careful examination of the records of the various instruments with reference to the periods of priming as shown on the chart on the recording calorimeter definitely established the following causes of priming:

1. An increase in forced draft caused by a sudden speeding up of the blower.
2. Feeding the water in slugs.
3. Carrying the water high in the glass.
4. Pop valves blowing when boiler was working at fairly high rating.

These causes were eliminated one at a time, as follows:

An automatic air-actuated steam-pressure control was developed to control the speed of the stoker and blower engines. This regulator caused the engines to change speed so uniformly that the changes were almost imperceptible. This was found to reduce priming very materially. A well-known expansion type of feed-water regulator was installed which gave a fairly

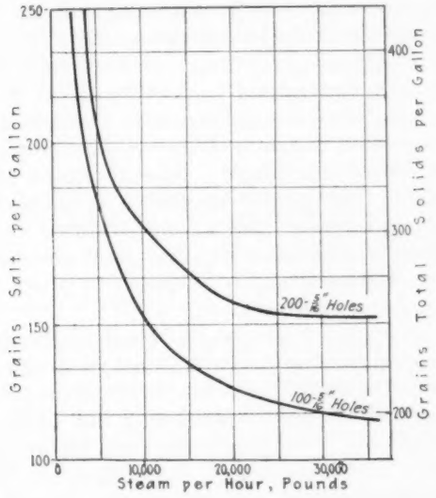


FIG. 2—RELATION BETWEEN PRIMING AND CONCENTRATION OF BOILER WATER; EFFECT OF NOZZLE PLATES OF DIFFERENT AREAS.

uniform feed. This also proved to be of considerable value, but trouble was still experienced in operating at high rating.

After these changes had been accomplished a series of tests were run with a dry pipe installed and also with a dry plate. The dry plate proved to be of no value. The dry plate consisted of a piece of boilerplate with a certain number of $\frac{5}{16}$-in. (7.9-mm.) holes drilled in it. This was bolted over the steam nozzle. The curves in Fig. 2 illustrate the results which were attained with the plate. As will be seen, it was found that as the area of the holes in the plate was restricted less priming occurred. However, when the plate was sufficiently restricted tc affect priming materially a serious pressure drop through the plate developed at high ratings, making it impossible to keep the pressure in the various boilers the same. The plates were finally abandoned mainly for this reason.

It was finally decided to remodel one boiler as shown in Fig. 1. An exhaustive series of tests were then made which proved that it was almost impossible to cause priming in the remodeled boiler. As a conclusive test, the boiler charged with water containing 1500 grains per gallon (24 gm. per liter) of solids was repeatedly forced from rating to 300 per cent rating in the shortest possible period of time. Practically no signs of priming were observed.

The remodeling consisted in an addition of a 36-in. (91-cm.) by 13-ft. (4-m.) dry drum, installed above the center drum. Special water-circulating tubes were installed between the middle and rear drums. The dry drum was connected with the rear drum by means of sixteen tubes. The upper ends of these tubes were covered by a baffle. The outgoing nozzle was protected by a nozzle plate of ample area. The nozzle castings between the dry drum and middle drum were blanked off, except for two 2.5-in. (6.4-cm.) drain pipes which carried down to within 0.75 in. (19 mm.) of the lowest point in the middle drum.

By this contraction the steam was drawn out of the rear drum where the water was comparatively quiet and the flow downward. By carrying the steam up through tubes having a very ample area, 111.7 sq.in. (720 sq.cm.), a certain amount of water was allowed to drain back. Finally any remaining moisture was thrown out against the baffle plate in the upper drum and drained back into the middle drum. A gage glass installed on the dry drum proved that at no time did any water accumulate in this drum.

The results of these tests were so satisfactory that the entire battery of twelve boilers was remodeled after the same plan, at an average cost per boiler of $645. The results were eminently satisfactory.

Book Review

PRINCIPLES OF TRANSFORMER DESIGN. By Alfred Still. New York: John Wiley & Sons, Inc. 216 pages, 67 illustrations.

This little book is a singularly useful and practical account of the necessary procedure in designing commercial transformers, from the small units intended for house lighting to the very large ones utilized in high-tension transmission. The general principles of transformer design have been often well set forth, but the ordinary discussions of the subject do not take into account a good many things which are of much importance in putting the fundamental principles into practice. Such, for example, are the questions relating to the insulation of high-tension transformers and the interesting and extremely important matters relating to the dielectric strains encountered at high voltages and their application to such vital things as the design of the terminal bushings required for the outgoing leads. Mr. Still's treatment of the details of artificial cooling as related to the efficiency and heating of transformers will be found especially useful in supplementing the general formulas of design with respect to the losses. We could wish that a little fuller discussion had been given to the matter of auto-transformers and regulators, both of which subjects have been rather generally neglected in treating practical design. Here at least will be a valuable opportunity for additions in an ensuing edition of this work. A word of thanks is due the author for the complete list of symbols tabulated at the beginning of the book. Nothing is more exasperating than chasing a symbol through imperfectly indexed pages, and Mr. Still's benevolent example is one which should be widely followed.

Comments on Proposed A. I. E. E. Changes

Points to Be Considered by Board of Directors at Its August Meeting—Opinions of Members on the Changes Proposed—Need of Wider Publicity on Plans That Have Been Formulated

AT THE August meeting of the board of directors of the American Institute of Electrical Engineers the report of the development committee will be presented for action. It will embody the recommendations that were discussed at the Lake Placid meeting as given in full in the Aug. 2 issue of the ELECTRICAL WORLD, pages 241 and 242. In this later report of the development committee certain modifications of the original proposals have been made, based upon the discussions at Lake Placid and since. In the main the changes and modifications are more in form than in scope of the original proposals.

It is held by many who are informed that their effect will be to lower the standards and activities of the Institute to meet a popular interest, particularly the interest of the younger members and those who may have engineering aspirations among members of student branches. This is said to be brought out particularly in the sections of the recommendations devoted to "Activities" and to "Engineering Congress."

REVISED RECCOMMENDATIONS OF COMMITTEE

The committee transmits the opinion that it is an almost unanimous view that the *Proceedings* do not now seem sufficiently to interest the membership at large. It presents definite recommendations under the six headings of the original draft, namely: (1) Publication; (2) Organizations; (3) Activities; (4) Local Federation; (5) National Council; (6) Engineering Congress. The essential features of the recommendations in revised form are as follows:

1. *Publication.*—To enlarge the editorial and executive publication staffs in order to expand the *Proceedings.*

To publish additional matter of live interest and value to the membership as a whole without giving less importance to the fundamental advance in the art and to original investigation work.

To publish all Institute papers and occasional papers of unusual broad general interest from sections or other sources.

To publish a set of abstracts of every paper presented at every section.

To eliminate duplication of expense heretofore incurred by publishing papers in both the *Proceedings* and the *Transactions* without depriving members of the latter.

To increase the revenue of the *Proceedings* by securing more advertising and, if necessary, to change the present size of its page.

To print advance copies of some or all section and perhaps branch papers but limit their distribution

In this connection it is recommended that means be adopted to stimulate section activities and to interest the membership at large, especially the younger members, in Institute work. To do this it is considered advisable to decrease the number of Institute meetings at headquarters calling for the attendance of officers and hold them in different parts of the country, the expenses of officers and board members to be provided. It is also recommended that the officers be chosen from different geographical sections of the United States.

2. *Organizations.*—The recommendations under this heading are the same as originally proposed (ELECTRICAL WORLD, Aug. 2, page 241).

3. *Activities.*—Same as originally proposed (ELECTRICAL WORLD, Aug. 2, page 241).

4. *Local Federation.*—Same as originally proposed (ELECTRICAL WORLD, Aug. 2, page 241).

5. *National Council.*—Same as originally proposed (ELECTRICAL WORLD, Aug. 2, pages 241 and 242).

6. *Engineering Congress.*—Substantially the same as originally proposed (ELECTRICAL WORLD, Aug. 2, page 242). It is recommended in addition that technical schools establish a six years' course in engineering with two years devoted to arts and sciences, including political science, economics, history, general letters, etc., and the remaining four years devoted to fundamentals of diversified engineering. Vocational training in industrial centers is also suggested. A joint committee of engineering organizations is proposed to promote such a national educational program.

Reference is also made in the report to the appointment of a committee at the Lake Placid meeting to study the policy of the Institute toward student branches and the possibilities of further developing this phase of Institute activities. This matter has been informally discussed with the development committees of the four other founder societies, and the matter is still under discussion relative to joint action with these societies.

Past-Presidents and Others Need More Time to Study Proposed Changes

In conformity with the request of the ELECTRICAL WORLD, which has thrown its columns open for a more extended discussion on the proposed changes in the activities of the American Institute of Electrical Engineers, a large number of letters have been received during the past week. As indicative of the unsettled state of mind of many of the influential members of the Institute, as well as the lack of knowledge on the proposed changes, communications of the general tenor reflected in the excerpts below have been received from eleven past-presidents of the Institute:

I have not studied the matter carefully enough to warrant my expressing an opinion.

I wish I could possibly find time to study this matter and communicate my conclusions to the ELECTRICAL WORLD. The pressure of other matters upon me, however, absolutely prevents.

I regret my time is so taken up that, nothwithstanding my interest in the Institute, I have not been able to read the proposed plans carefully, much less am able to dictate anything of any value regarding it.

I have your letter in regard to the report of the development committee of the A. I. E. E. I appreciate your asking

me to express my ideas in regard to the matter in writing, but I confess my own ideas are not sufficiently crystallized as yet to put them in writing. The whole question of the relations between the engineering societies and the Engineering Council is a very big one, and I do not feel that I am in a position as yet to commit myself in regard to such an important issue, for my own ideas are changing constantly, almost from day to day, in regard to the matter.

Other communications from fellows of the Institute, two of whom are connected with prominent committees, indicate the same general unfamiliarity with the proposed changes:

I am naturally taking interest in the subject, but doubt whether I could make any useful suggestion before I have studied it thoroughly.

I have not had an opportunity as yet to study the report of the convention, and until I do so I cannot tell whether or not I have anything to say in discussing the matter.

Yours of the 18th received and am very sorry that I cannot do justice to the question you bring up, as I was unable to attend the A. I. E. E. meeting and only know what has been printed in the *Transactions*, July number, and the details of the report in the July 5 issue of the ELECTRICAL WORLD.

I have received your letter of the 18th and am very much interested in the subject of the activities of the A. I. E. E. and the question of a change in the publication issued by the Institute. As I have not seen a complete copy of the report of the development committee presented at the convention, I hardly feel like attempting a public discussion until after I am familiar with its details. From what I gather in reading the report in the ELECTRICAL WORLD, however, I should be very much opposed to the proposed change in the form of the publication.

I have been trying to gather information on the subject of the development of the Institute and at the same time trying to keep an open mind so that when the report of the development committee comes before the Board of Directors I shall be able to give it fair consideration. Your reference to apparent undue haste is, I believe, due to misconception. In any case, however, you can be sure that there is no disposition to rush anything through, nor is this possible. The subjects referred to in the tentative report at Lake Placid can, of course, be the basis of considerable argument, and no doubt most of us have our own pet schemes that we think are superior to all others. I know I have, but I am trying to get some clear principles fixed in my own mind so as to be able to act intelligently on the development committee's report when it is presented to the board.

More extended comments by members who have studied the proposed changes of the development committee are appended.

Opposed to Popularizing and Commercializing A. I. E. E. Proceedings

To the Editor of the ELECTRICAL WORLD:

SIR: As to the A. I. E. E. development committee report:

1. *Publication.*—I believe that certain economies and better printing facilities can be obtained by changing the size of the *Proceedings*. Personally I would prefer the standard letterhead size, which is about 8½ by 10½ in.

I do not like the idea of making a popular magazine of the *Proceedings*. In this respect your editorial comment quite aptly expresses my sentiment. In the past I have influenced a great many young engineers and also many practical electricians to become members of the Institute. In doing this my chief argument has been to point out the high quality of the papers in the *Proceedings*. No technical magazine published fills this requirement. The *Proceedings*, as published to-day, is far above the publication of any other technical society except possibly the *Journal* of the Franklin Institute. The publication of the British Institution of Electrical Engineers cannot compare with our *Proceedings* except in conservatism, which is the feature the leading body of electrical engineers of the world should most jealously guard.

I am heartily opposed to using the *Proceedings* as an advertising medium. When the electrical engineers of America get so poor that they cannot publish their technical papers without the assistance of advertisers, they had better disband their organization rather than stoop to such base means. The absence of advertisements is another argument I have used in obtaining new members.

During the war period the N. E. L. A. made a slight extra charge for the annual bound volume of papers. This seems preferable to making our *Proceedings* an advertising bulletin.

2. *Organizations.*—This section of the report is very good and can be carried out to the advantage of all concerned. The Institute should then hold its midwinter and annual conventions as its only meetings.

The *Proceedings* should contain the papers presented at all section meetings or should contain all important papers in full and a digest of the less important ones. This would give the entire membership the benefit of papers presented at all meetings.

The remainder of the report has many good points but requires considerable study and care in carrying out the plan proposed. P. H. ADAMS.

Newark, N. J.

Dr. Steinmetz's Suggestions Indorsed

To the Editor of the ELECTRICAL WORLD:

SIR: I have carefully read the suggestions made for proposed changes in the A. I. E. E. activities. I have also read with equal care Dr. Steinmetz's comments, and he has so well and completely stated my own views that, with a single exception, I subscribe to them.

He offers one suggestion which I consider undesirable, namely, that each member return his copies of the monthly *Proceedings* for final binding at the end of each year. There are several objections to this, the chief one being that many engineers who gather data bearing on certain subjects tear out from the monthly *Proceedings* all papers and discussions that bear on these particular subjects and file them with the main body of the data being accumulated. This is a convenient method of arranging material for future reference.

Another objection is that it would be necessary to gather all the pamphlets, pack them up and ship them to the designated officer of the Institute. This would entail considerable trouble, even if all the numbers were in the office, but as every engineer who reads the *Proceedings* knows, they are widely scattered, some at his office, some at his residence, with occasional ones left in suburban laboratories. Altogether, this proposed arrangement would entail so much trouble that many members would not undertake to collect and return the pamphlets for binding.

We have a good system that has been satisfactory to practically the entire membership, and not a single one of the suggested changes will improve it.

New York, N. Y. LAMAR LYNDON.

Three Distinct Angles Presented

To the Editor of the ELECTRICAL WORLD:

SIR: The keen interest taken by those who attended the Lake Placid convention of the American Institute of Electrical Engineers in the report of the development committee is sufficient testimony to the careful and conscientious work of the chairman and the other members of the committee. I was asked to state my suggestions to this committee at the April meeting of the Philadelphia Section, and my thoughts at that time were transmitted by the chairman of the Philadelphia Section in his report to the development committee. The final report of this committee gives me an opportunity to comment further concerning the proposed changes in the Institute's activities.

In considering such changes it is my opinion that the problem should be viewed very carefully from three distinct angles, namely, (1) the voluntary nature of the work, (2) the conglomerate membership, (3) democratization. Apparently these three points have had the consideration of those loyally interested in the Institute as they are unconsciously involved in the recommendations made at the recent convention. In like manner they appear in the various discussions by the membership at large. For this reason there can be no hesitancy in discussing them.

As to the voluntary nature of the work, there are a number of engineers whose occupation permits them very little time to reduce their accomplishments to writing. There are others who see duties grow to be routine or monotonous, and it does not appear to them that a description of their work would be of any value to unallied interests. There are still others who are perfectly willing to aid the Institute in every way possible but require the assistance of those who can give their time to put their valuable data in permanent form. The Institute is always dependent upon the voluntary exertion of the membership as a whole, but this will necessitate, as it has in the past, a staff of experts to shape the material for publication.

Any changes in the *Proceedings* of the Institute will mean an enlargement of the present staff at headquarters by the addition of more specialists—specialists not only in the sense of electrical engineering but experts in the publishing business. This will require not a corps of engineers so much as men well acquainted with this business and skilled in its conduct. Naturally the question that immediately arose in the discussion was whether or not the Institute would be adding to a field now well covered. To meet this expense advertising will be resorted to on a large scale, and it would seem as if the Institute would thus not only lose prestige but enter a field for which it was not organized.

Passing from the consideration of the voluntary nature of the Institute work and its dependence upon the membership, we should consider the diversified character of the organization. In the growth of years the Institute has wisely endeavored to associate men who are interested in the art and practice of electricity. This body of men has grown side by side with the growth of the manufacture and use of electrical energy. The outcome has been the attenuation of the interests of the Institute in the various applications of electricity. Consequently we find to-day a large number of members only incidentally interested in electricity and whose regular duties would hardly permit them to stand within a strict definition of an engineer. One instance of this we find in the scientist. He is usually a college professor, conversant with the laws of nature and experimenting in his laboratory. His duties are not strictly those of an engineer, and he utilizes electrical theories only as they may pertain to the investigations in hand.

If the Institute publications and policies were to be dominated by these specialists, it is natural that the prestige of the Institute would lie solely in highly theoretical and mathematical papers. If, on the other hand, the prestige of the Institute is upheld by the engineer, the papers will be those describing the accomplishments of the engineer. I am of the opinion that the right place for the highly scientific and learned papers is in the scientific libraries so that those engineers who are in need of such material will not be confused by looking for it in the files of engineering societies. This opinion is based on a desire for a reduction of confusion in required reference work.

As in the world at large, the Institute itself should be a free-for-all forum. There must be leaders who are capable of guiding the diversified opinions of the membership and a free voice in the government, administration and policies of the Institute must at all times be permitted. I think that the suggestion of decentralized committee work carries with it some such thought as this, and, as the section work of the Institute has proved for so many years to have been instrumental in broadening and enlarging its value, it would be much wiser to do away with what are known to-day as Institute meetings. The results of value in these meetings could be accomplished by the suggested yearly congress or by holding, as is the custom now, two conventions a year.

These comments are made with no intention to criticise the policies and past administrations of the Institute. They are intended only to aid in the constructive suggestions which were so splendidly laid before the membership by the development committee at Lake Placid.

H. A. HORNOR.

Minerva, N. Y.

Expansion of Journal Favored

To the Editor of the ELECTRICAL WORLD:

SIR: The report of the development committee of the A. I. E. E. commends itself to me as it represents the desires of the majority of the members, who, having been given the opportunity to express their views, have done so. Unfortunately, owing to the carelessness of several members who did not familiarize themselves thoroughly with this report, much of the time which was to have been devoted at Lake Placid to its discussion was spent in discussing something entirely different. This applies both to the meeting of the development committee and the open meeting. At the former meeting much time was wasted because it was not clearly understood that it was a meeting of the development committee. At the open session much time was wasted because certain members were under the erroneous impression that the development committee proposed to eliminate highly technical and mathematical papers from the proposed journal.

If this were so, I should certainly disapprove of the report, but so far is this from being the case that the proposed journal will afford a medium of publication for many technical articles which cannot now find their way into print.

WILLIAM A. DELMAR.

New York, N. Y.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MICA-INSULATED COIL FOR HIGH TEMPERATURES

Will Withstand Temperature of 150 Deg. C. and Can Be Employed on 11,000-Volt Alternating-Current Generator

One of the greatest problems in designing high-speed machines with relatively large output is to afford adequate ventilation of the windings. Where the radiation is not sufficient to maintain the relatively low temperatures which were formerly allowed in electrical apparatus it has been necessary in modern designs to provide insulation which will stand high temperatures. For this purpose the Westinghouse Electric & Manufacturing Company has developed a 150 deg. C. (292 deg. Fahr.) coil which is suitable for 11,000-volt alternators for hydroelectric service.

The coil consists of two conductors, each composed of six 0.204-in. (0.52-cm.) square bare copper wires in parallel, each wire being painted with "bakelite" and insulated with one layer of mica tape to reduce eddy-current losses. Each conductor is then bound with thin cotton tape (structural material only). This is followed with the application of the conductor insulation, which consists of two layers of mica tape and one layer of thin cotton tape (structural material only).

The conductors are next assembled with a reinforcing strip of pure mica between each, and the complete coil is bound with thin cotton tape and the straight portions of the coils which are embedded in the slots treated with bakelite. This operation is followed by placing the straight portions in a special steam-heated and water-cooled press, and pressing them to a predetermined size, rendering that portion subjected to high temperatures solid and unaffected by subsequent treatments and operating temperatures. The coil is then given a vacuum and impregnating process in "hydrolene." After this operation, the application of the mica wrapper on the straight part embedded in the slot, together with the taping of treated cloth tape on the coil end, forms the outside or coil insulation to ground. This wrapping and taping is applied in two operations, the ends of the wrapper being made in a tapered form, permitting a sealed joint between the wrapper and the taping. This junction is also treated with a special cement.

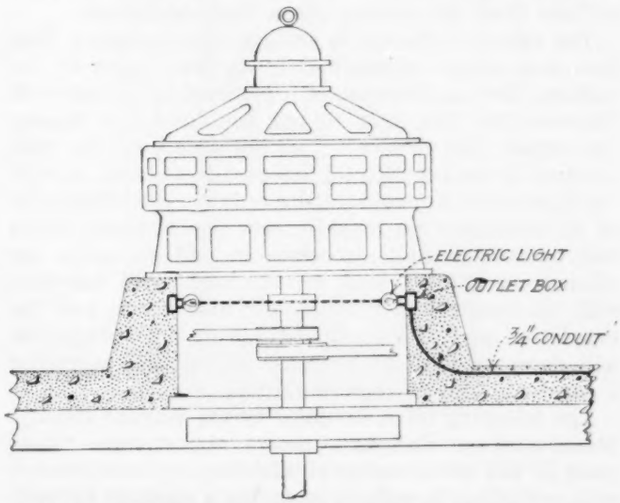
The wrapper is first applied to the coil in a sheet form by hand, being drawn around the coil as tightly as possible. The coil is then placed in a special wrapping machine, equipped with electrically heated plates under tension, revolving around the wrapper. This softens the bond and permits the wrapper under the pressure of the revolving plates to slide on itself. The result is an extremely solid and compact insulation. The coils are then removed from the wrapping machine and pressed in a cold press. The taping of varnish-treated cloth is applied over the coil ends, each layer being brushed with a moisture-resisting varnish, and the coil ends and portions of the wrapper projecting beyond the laminations beyond the core are finished by taping with a layer of cotton tape, which is again treated several times in moisture-resisting varnish.

The percentage of mica in the wrapper is about 60 per cent and can be increased to approximately 80 per cent by inserting additional sheets of hand-built mica between the turns of the micarta folium wrapper.

LIGHTING THE SPACE UNDER WATERWHEEL GENERATOR

Inaccessible Places Which Are Hard to Inspect Are Conveniently Lighted by Means of Permanent Fixtures

Although portable hand lamps usually serve well for lighting dark parts of machines for inspection purposes, interiors are sometimes hard to inspect in this way because the workman will have to place his lamp in the same opening into which he looks. The attendant



PERMANENT LAMPS AFFORD AMPLE ILLUMINATION FOR PURPOSES OF INSPECTION

glare and intense light directed into his eyes will often make inspection of parts difficult.

In the new hydroelectric plant at Lowell, Mich., provision was made for lighting the space under the waterwheel-driven generators when the plant was designed. Outlet boxes and 0.75-in. (1.8-cm.) conduit were laid in the concrete generator support. When the lamps were installed as the plant was put into operation, they made it much easier for the plant operators to observe the condition of the apparatus because the lights were placed in the interior. The Lowell plant was designed by Holland, Ackerman & Holland, Ann Arbor, Mich.

EFFECTS OF OPERATION ON TRANSFORMER PERFORMANCE

Copper Loss, Iron Loss, Efficiency, Regulation and Heating of Transformers Under Changes of Voltage, Load, Frequency and Wave Form

Performance figures usually given on transformers include iron loss, copper loss, voltage regulation at 100 per cent and 80 per cent power factor and efficiency at one-fourth, one-half and three-fourths full load and one and one-fourth times load. Iron loss or core loss is independent of load and of temperature, but copper varies as the square of the load; *i.e.*, at one-half load it is one-fourth and at one-fourth it is one-sixteenth as large as at full load. Copper loss also varies with the temperature of the transformer and increases approximately 2 per cent for each increase in temperature of 10 deg. Fahr. (55 deg. C.) Copper loss, regulation and efficiency guarantees are calculated for a copper temperature of 75 deg. C. (167 deg. Fahr.), since that is an average operating temperature.

The regulation is proportional to the load; *i.e.*, at one-half load it is one-half, and at double load it is twice as great as at full load. It will increase with the temperature, but the increase will not be so rapid as in the case of copper loss owing to the fact that the inductance and reactance drop are not affected by the resistance of the winding.

Transformers constructed for three-wire operation on the low-voltage winding will carry half load on one-half of the winding with no load on the other, with a voltage difference between the two parts equal or less than the values given for regulation.

The effect of change in voltage is as follows: The iron loss varies approximately as the square of the voltage, thus an increase of 5 per cent in voltage will increase the iron loss 10 per cent and vice versa; the copper loss also varies as the square of the voltage but decreases with an increase in voltage, assuming a constant kilovolt-ampere output; the efficiencies of distribution-type transformers at fractional loads will decrease with an increase in voltage, while the efficiencies at full load or overloads will increase with an increase in voltage, and vice versa, and the regulation will vary as the square of the voltage but will decrease with an increase in voltage, assuming a constant kilovolt-ampere output.

The following table, compiled by the Wagner Electric Manufacturing Company, shows approximate variations in the performance of distributing transformers with variations in voltage, assuming a constant kilovolt-ampere output:

Voltage	Iron Loss Per Cent	Copper Loss Per Cent	Regulation Per Cent
2200	91	109	109
2300	100	100	100
2400	109	91	91

Iron temperatures increase and copper temperatures decrease with an increase in voltage, and vice versa, for a constant kilovolt-ampere output.

The effect of changes in frequency can also be summarized, as follows: The iron loss will increase with a decrease in frequency. A 60-cycle transformer will have approximately 11 per cent higher iron loss when operated at 50 cycles than at 60 cycles. The iron loss of a 60-cycle transformer operated on 25 cycles is so high as to make such a practice impossible. It is however, possible to operate a 25-cycle unit on 60 cycles, and in this case the iron loss will be decreased 25 per cent. In distribution transformers the copper loss is practically independent of the frequency.

Inasmuch as the copper loss is not affected by the frequency and iron loss is increased by a decrease in frequency, a given transformer efficiency will be less at a low frequency than at a high one. The regulation at 100 per cent power factor is not affected appreciably by a change in frequency since ohmic drop is independent of frequency. The reactance drop is so affected, however, and the regulation at low power factors will decrease with a decrease in frequency and vice versa. Thus the regulation of a 25-cycle transformer when operated on 60 cycles and at low power factors will be very much poorer than when operated at 25 cycles. As the total loss is greater at a low frequency than at a high one, the temperature will be correspondingly increased.

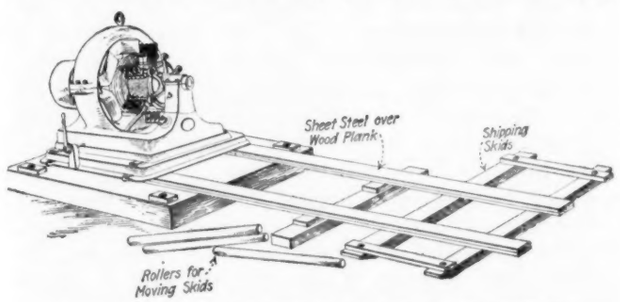
Performance data are based upon operation on circuits having a sine wave of emf. A peaked wave will give lower values of iron loss while a flat top wave will give higher values of iron loss than those given in the tables, with corresponding increase and decrease in efficiency. Copper loss and regulation are practically independent of wave form, while the heating is slightly less on circuits having a peaked wave and silghtly greater on circuits having a flat wave than on those with sine wave.

METHOD OF REMOVING GENERATOR FROM BASE

Removal Facilitated by Means of Sheet Steel Placed on Planks—An Application of Oil Also Expedites Work

It is an easy matter to move small electrical machines around the shop, but when it is necessary to move a large machine the task is more difficult. One of the best methods of removing a generator from its base is as follows:

Unbolt the base of the machine from the foundation and by means of crowbars pry the base so that long, heavy planks may be inserted beneath it. Movement of the machine along the planks can be facilitated by fastening wide strips of sheet steel on the planks and by applying a little oil. If the sliding angle is very large, however, too much oil may cause trouble as the machine may become uncontrollable. Enough blocking must be placed under the planks to prevent them from breaking and care should be taken to place the blocks over solid flooring. Otherwise a machine having a high center of



GENERATOR SLIDES OFF BASE ON TWO LONG PLANKS

gravity is apt to lose its balance in the event of a block failing.

The generator should be slid directly to shipping skids if it is to be taken away from the shop, otherwise it can be placed on a stout truck. After it is bolted securely to the skids, it can be transported by means of pipe rollers in the usual manner. The skids should be at least 4 in. by 6 in. (10 cm. by 15 cm.) or 4 in. by 8 in. (10 cm. by 12 cm.). Cutting the ends of the skids diagonally makes it a simple matter to place the rollers underneath.

East Berlin, Conn. H. S. RICH.

NUT FIT FOR BOLTS WITH SHORT THREAD LENGTH

Play Encountered with Nuts Having a Finger Fit Is Eliminated and Likelihood of Thread Stripping Under Stress is Reduced

In order to determine whether guy clamp and other similar bolts having a short length of thread are better suited to line work if equipped with tight-fitting nuts that can be turned down the entire length of the threads with the fingers as at present, one company has made extensive field trials of three-bolt guy clamps equipped with bolts conforming to the requirements that are stated below.

These field trials show that there is a decided advantage in the use of tight-fitting nuts, since the play sometimes encountered with nuts having a finger fit is eliminated and consequently there is less likelihood of the threads of the nut or bolt stripping under stress. Moreover, it is obvious that any tendency for the nut to work loose under vibration is greatly reduced by the tight nut fit, because the friction between the threads of the bolt and nut is greater. These trials also show that the finger fit on the nut at the end of the bolt enables the clamp sides to be placed as readily on the strand as at present, and that the use of a wrench for the remaining distance is not objectionable on a account of the short length of thread which the nut has to traverse in being set up.

As the relatively tight nut fit does not affect present practice in the use of bolts having a short thread, and since it offers advantages, it should be made a standard part of all specifications covering material having short screw threads.

The materials and specifications involved are guy clamps, rock guy bolts, malleable-iron clamps, cross-over clamps, suspension clamps, galvanized bolts (short) and steel insulator pins.

The requirements are as follows:

All bolts shall be free from badly formed or otherwise defective heads. The threads shall be full and clean and concentric with the axis of the bolts. When the ends of the bolts are chamfered or rounded all threads of the bolts shall be of full diameter. When the ends of the bolts are not chamfered or rounded good threads of full diameter are required, except for a distance at the end of the bolt equal to the pitch of the thread.

The nuts shall be symmetrically formed and shall have the holes centrally located. The axis of the threads shall be reasonably perpendicular to the face of the nut, so that when all the threads of the nut are engaged with those of the bolt the distance from a plane perpendicular to the axis of the bolt to any two diametrically opposite corners of the flat face of the nut shall not differ by an amount greater than 1/16 in.

All bolts shall be furnished with the nuts run down upon the threads for a distance not less than the thickness of the nut. When the face of the nut is flush with the end of the bolt the fit shall be neither so loose that any play or rocking between the nut and the threads of the bolt can be felt nor so tight that the nut cannot be turned off with the fingers or run down the remaining length of the threads with a 6-in. wrench.

In using the above specifications for steel insulator pins, the requirements apply only to the lower spindle and the word "spindles" should be inserted in every case where the word "bolt" appears.

The specifications printed above were drawn up by H. E. Weightman, chief engineer of the Engineering Service Company of Chicago.

SMALL COMMUNITIES SERVED FROM HIGH-TENSION LINES

Line Structures Utilized for Purpose of Carrying Switching Protective and Transformer Equipment on Both Wood and Steel

An operating company in the Northwest is serving small towns and farming communities directly from its 13,200-volt transmission lines by erecting a unit-type steel-tower substation with a platform arranged for use with two transformers in open delta or three transformers in closed delta. A typical installation made by the Delta-Star Electric Company is shown in the halftone, having two 25-kva., 13,200/2300-volt, single-phase transformers, disconnecting switches, choke coils and carbon-tetrachloride fuses mounted on a steel structure.

TYPICAL WOOD AND STEEL STRUCTURE WHICH MAKES ECONOMICAL SUBSTATION

The disconnecting switches, coke coils and fuses are mounted vertically, and the secondary distribution and metering equipment is contained in a housing at the foot of the tower, just ahead of the substation, to be entirely isolated when desired. A three-pole set of lightning arresters is separately mounted ahead of the switch, thus giving protection to both the switch and substation.

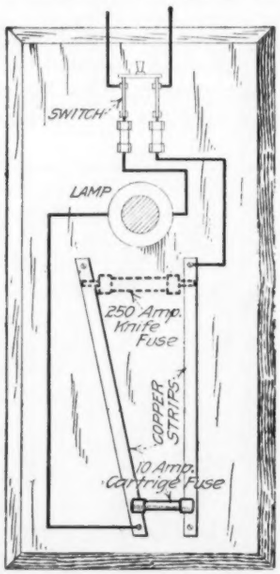
INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

QUICK TESTING DEVICE FOR CARTRIDGE FUSES

Both Knife and Ferrule-Type Fuse, from the Baby Size to 250 Amp., Tested by Means of Copper Straps on Board

For allowing the electrician to test fuses quickly and easily to determine whether or not they are blown a simple arrangement has been constructed as shown herewith. It consists of two copper straps about 8 in.



STRAPS CAN BE ARRANGED SO THAT ANY FUSE CAN BE TESTED

(20 cm.) long and 1 in. (2.5 cm.) wide attached to the test board so that they are arranged at an angle to each other about 1 in. (2.5 cm.) apart at the bottom and 6 in. (15 cm.) apart at the top. These two straps are then connected in series with an indicating lamp and a source of energy. When a fuse ranging from the baby size to 250-amp. rating is placed across the straps the lamp will indicate its condition.

New York. CHARLES E. SMITH.

HIGH-VOLTAGE LAMPS PREVENT THEFT IN PLANT

Because Circuits Operate at 125 Volts, While Potential in Workmen's Homes Is 110 to 112 Volts, Little Lamp Stealing Takes Place

An Ohio industrial plant covering about 1200 acres has found that a difference of 15 volts between the potential of its lighting circuits and those of the local service company is enough as a rule to prevent dishonest employees from taking incandescent lamps. In the industrial plant lighting circuits all operate at 125 volts, which permits the use of two lamps in series where only 250-volt direct current is available.

This same plant also uses Hubbell locking lamp guards because they prevent workmen from changing lamps for themselves instead of calling for the authorized employee in charge of lamp distribution.

WIRING AND CONTROL FOR LARGE ELECTRIC FURNACE

Separate Transformer Sets Are Provided for the Two 15-Ton Furnaces in Order to Save Investment in Low-Tension Wiring

The electric furnace installation of the Sizer Forge Company, Buffalo, N. Y., affords an interesting example of control methods planned along advanced lines. Two 15-ton Heroult furnaces are now completely installed in this plant, Fig. 1 showing one of the outfits with wiring, electrodes, electrode holder and motor-operated charging door. Energy is supplied from the Niagara Falls hydroelectric system at 11,000 volts to a transformer installation of 6000-kva. rating. To save investment in the low-tension wiring two transformer sets are provided, each near its furnace, with independent switchboard of three panels for each unit. The furnaces were installed to produce electric steel forg-

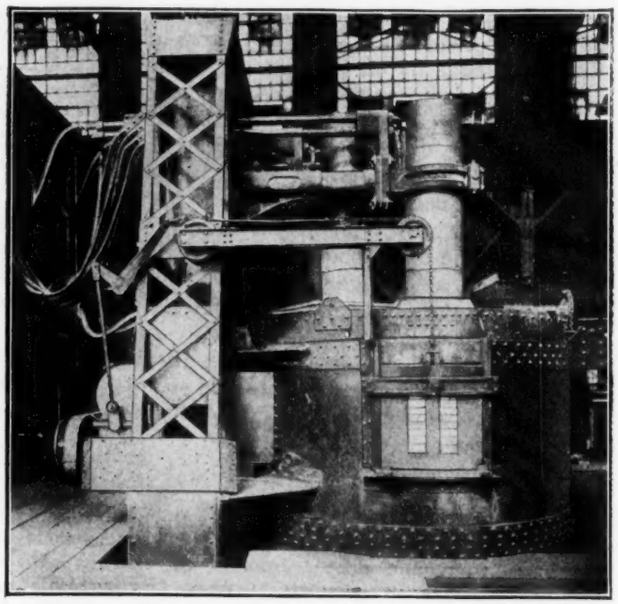


FIG. 1—15-TON FURNACE WITH MOTOR-OPERATED CHARGING DOOR

ings and also castings for automobile service, the latter being expected to prove almost as strong as the former for this work.

The secondary service is provided at from 100 volts to 150 volts, three-phase, according to transformer taps, and at full load about 16,500 amp. is required per furnace. The electrodes are of carbon, 24 in. (60 cm.) in diameter, and have water-cooled clamps and hold-

ers. Each holder contains about 1500 lb. (700 kg.) of copper and bronze. The transformer secondaries are connected to a busbar structure of copper weighing about 1800 lb. (800 kg.) per furnace. From this structure twenty-four 2,000,000-circ.mil bare capped cables run to the electrode holders as shown in Fig. 1. These are driven through asbestos wood disks 2 in. (5 cm.) thick and about 24 in. (60 cm.) in diameter to prevent spreading of the cables under short-circuit conditions. The cables are wound on a 1-in. (2.5-cm.) asbestos core and are each composed of 756 strands of copper to give the desired flexibility. Eight cables are required per phase, or twenty-four per furnace, and five 230-volt direct-current motors are provided for each furnace.

Reactors (Fig. 2) are installed in the primary circuits of the transformer to reduce the effect of the furnace demand upon regulation. The low-tension cables are terminated in cast terminals, the cores being removed from the latter to facilitate a tight joint.

The electrodes may be operated by push-button or by automatic control, according to the position of a two-way switch on the central panel of the switchboard. In the former case the electrodes are started and stopped at any desired point by push-button manipulation; in the latter the current desired is set at the rheostat handles on the left-central panel, and the contact-making ammeters on the panel below control the plunger switches on the top panel and thus stop the electrode motors at the proper point. Each furnace is equipped with the following switchboard instruments: one curve drawing wattmeter, three ammeters (one per phase), one power-factor indicator, one voltmeter and one wattmeter. The motor, transformer and control equipment was furnished by the General Electric Company, which also supplied a 200-kw. motor-generator set used in supplying direct current.

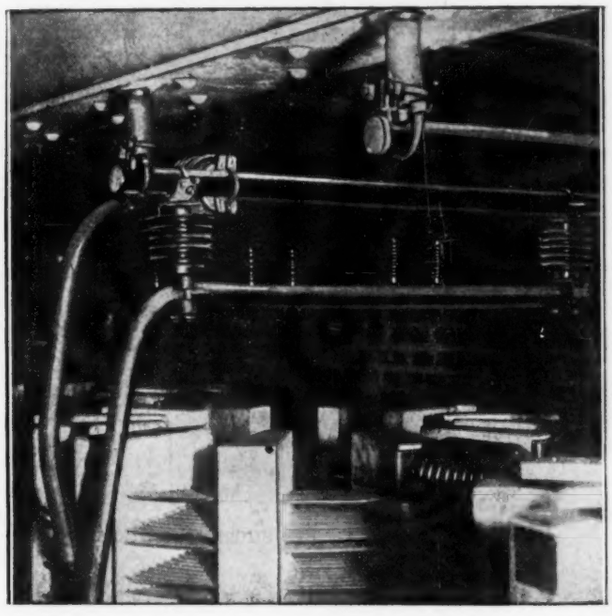


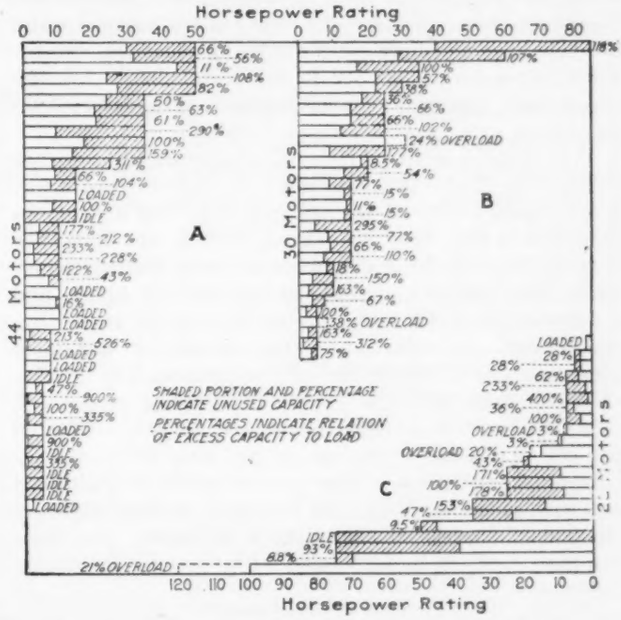
FIG. 2—LEADS TO REACTORS ARE HELD BY INSULATORS FROM PIPES AT RIGHT ANGLES TO EACH OTHER

The above information was contributed by J. J. Waddell, vice-president of the Whitall Electric Company, Springfield, Mass., who was formerly construction engineer for the Robertson Electric Construction Company, Buffalo, N. Y., on this installation.

A GRAPHIC METHOD OF SHOWING MOTOR LOADING

Illustrates Exact Relation of Power Demanded and Rating of Motor—Power Factor Affected by Over-Motoring

Rather than run the risk of having the motor driving a machine in an industrial plant prove too small to carry its load, the majority of manufacturers go to the other extreme and "over-motor" their machines. This



RESULTS OF TESTS IN THREE NEW ENGLAND FACTORIES SHOWING TENDENCY TO OVER-MOTOR

Factory shown at *A* manufactures small gasoline engines; test being made for central-station company with view to improved power factor. Factory shown at *B* manufactures cast-iron valves; test being made for central station with a view to change of supply from 550 volts direct current to alternating current. Factory shown at *C* manufactures drop forgings; test was preparatory to moving to a new location.

involves a loss of efficiency because the part of the no-load losses of a motor is proportional to the size of the motor and it is constant in a certain motor no matter what the load may be. In addition, the power factor is affected and a greater first cost is necessary. A comprehensive study of plant conditions, while it may take time, is usually worth the trouble taken if the information obtained is used.

In order to compile such information so that it could be used tests of the loads on the motors in three New England plants were plotted in horizontal blocks as shown in the accompanying chart. Over-motoring can easily be seen, for wherever surplus motor capacity exists it is shown in the shaded areas. For example, in the first plant, at the top of the diagram, there are five 50-hp. motors, six 35-hp. motors and thirty-three motors of smaller size, as indicated. The actual load on the first motor is 30 hp., giving an over-motor margin of 66⅔ per cent above actual load carried.

Serious underloading is also evident in the cases of the two other plants plotted. Of course, in many cases reserve motor capacity is required to meet expected increase in future demands, especially in group-driven plants; but the value of a chart like this lies in its quick appeal to the eye.

PAUL B. SELDEN,
Springfield, Mass. Electrical Engineer.

SOFT COPPER FAVORED FOR COMMUTATOR BARS

Although Having Only 60 per Cent Conductivity, It Is Found to Wear Better than Harder Castings of Greater Current-Carrying Capacity

Armatures which require new commutators do not necessarily need new windings, and when the connections and insulation are not to be disturbed the outside V collar of the commutator can be removed and each commutator bar taken away separately as it is loosened. The commutator shell may be removed and cleaned while the new bars and insulation are being obtained. Hard-rolled, drop-forged copper is seldom available for the repair man, but cast copper makes a satisfactory substitute.

The Commonwealth Edison Company of Chicago has found that if the castings are soft they have a minimum conductivity of 60 per cent and are free from blow holes; also, they wear from 75 per cent to 90 per cent as long as the hard-drawn or drop-forged copper bars. The castings are specified as soft but tough, and the low conductivity is due to the fluxes used in melting the copper. A reduction in the amount of flux used increases the conductivity of the copper, but it also tends to make the metal more brittle, more porous and liable to have blow holes below the surface. The 60 per cent soft-copper castings do not need filling or machining on the sides. They can be easily straightened and any projection flattened out on a surface plate by the aid of a steel flattener and a hammer. The bars are then ready to be assembled with the mica insulation between.

FLEXIBLE POWER SYSTEM FOR USE IN PAPER MILL

Four Complete Units Are Equipped with Individual Generating Equipment, but Any Mill Can Be Operated from Any Generator

Instead of having central generating for the entire power of the plant, the John Lang Paper Company of Philadelphia has four independent manufacturing units, each complete in itself, with each paper or board machine electrically driven and normally supplied with power from its own alternating-current generator. All the generators and paper-machine motor circuits are controlled, however, from a single switchboard, so that it is possible in case of trouble to operate any given paper machine with power from any one of the generators, which are the Westinghouse type.

This eliminates the probability of a complete shutdown of the mill. These power generators range in size from 200 kva. to 450 kva., but a fifth generator of 300 kva. is installed which is controlled from a separate section of the switchboard and is intended to be used on Sundays and holidays only. If desired all of the rest of the switchboard panels can be "deadened" for inspection, repairs, etc., while the small generator operates the lamps and provides enough power to make repairs.

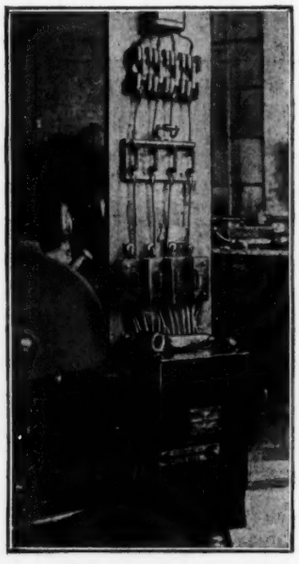
Three of the paper machines are driven by constant-speed a.c. Westinghouse motors of from 75 hp. to 100 hp., speed control of the variable-speed end being obtained by means of mechanical speed-changing devices, but the fourth machine is provided with a system in which the power is divided into two parts. The screens and pumps of the wet end are driven by constant-speed alternating-current motors, but the dryers and other parts of the variable-speed end are operated by a 75-hp. direct-current motor, with speed range of 5 to 1, which receives its current from a 60-kw. synchronous motor-generator set. A two-step cone pulley is also used so that a range of paper speed from 25 ft. to 125 ft. (7.5 m. to 40 m.) per minute can be obtained on one cone, and from 40 ft. to 200 ft. (12 m. to 60 m.) per minute on the other.

Another interesting motor application in this mill is the use of squirrel-cage motors with high-resistance end rings for driving the rag cutters. This type of motor has the characteristic of drawing relatively low current with high starting torque and slowing up whenever an extra heavy load is thrown on it, and then exerting a corresponding increase in power. This feature is useful when the knives of the cutter become jammed.

COMPACT SWITCH PANEL FOR CONTROL OF MOTORS

Motor Leads Are Brought Down from the Ceiling in Conduit and Are Connected to Fuse by Means of Open Wiring

A convenient home-made panel for motor control is in use at the plant of the Pratt & Whitney Company, Hartford, Conn., which is of 1-in. (2.5-cm.) planking, 14 in. (35 cm.) wide and 7 ft. (2 m.) high, and is diagonally braced by 1½-in. by 1⅝-in. (30-mm. by 40-mm.) angles. The motor compensator or starting box is mounted with the necessary fuses and main switch on the front within easy reach of the machine operator. The motor leads are brought down from the ceiling in iron conduit, which is clamped to the panel at the top, short wiring runs then serving to complete the installation.



HOME-MADE PANEL ALLOWS SHORT MOTOR LEADS

This method involves use of a very small amount of wire for leads to each motor and obviates mounting the switch, starting and fuse equipment on factory columns. It fits readily into a comparatively unused space at the end of the diagonally set machine tool.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

COLUMBUS SYSTEM OF CUSTOMERS' RECORDS

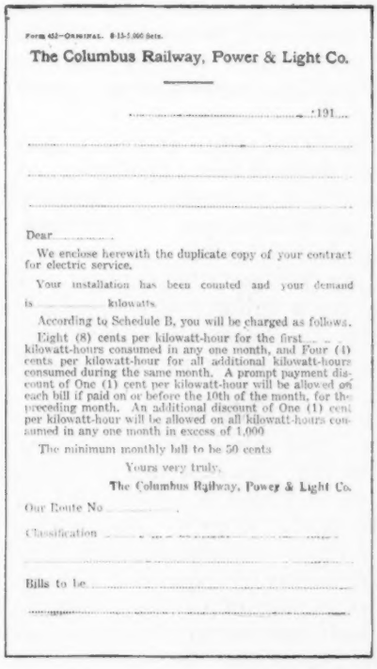
Count Made of the Customer's Demand and Details of Method Followed in Notifying Him of Basis of Rate Charges and of Recount

After the contract is signed by a customer of the Columbus (Ohio) Railway, Power & Light Company and current turned on, a count is made of the customer's demand. The form used for this record has on the reverse side the name and address of the customer and other information for the line department.

Following this, forms which are printed and padded up to register are filled in. One is mailed to the customer, and one sent to the cashier as his order from the new-business department to open an account. A third blank sheet is padded up with the rest for the files of the new-business department.

With this information in his hands, together with the handbook given him containing full information on the rate schedules and illustrative examples, the customer has the exact basis of his charge before him and may satisfy himself as to its correctness. Other similar forms are made up for customers using power under other rates. These have the particular rate applying printed in.

If the customer changes his maximum demand at any time, he is given a recount at his request, and of course the company makes periodical recounts, after which the customer is mailed a new notice of rate of charge. A carbon copy of this addressed to the cashier is printed to register with it, and this notifies him of the change in basis for computing bills of that customer.



Form 452—Original. 8-13-5,000 Sets.

The Columbus Railway, Power & Light Co.

.....,191....

Dear.....

We enclose herewith the duplicate copy of your contract for electric service.

Your installation has been counted and your demand is.....kilowatts.

According to Schedule B, you will be charged as follows.

Eight (8) cents per kilowatt-hour for the first..... kilowatt-hours consumed in any one month, and Four (4) cents per kilowatt-hour for all additional kilowatt-hours consumed during the same month. A prompt payment discount of One (1) cent per kilowatt-hour will be allowed on each bill if paid on or before the 10th of the month, for the preceding month. An additional discount of One (1) cent per kilowatt-hour will be allowed on all kilowatt-hours consumed in any one month in excess of 1,000

The minimum monthly bill to be 50 cents

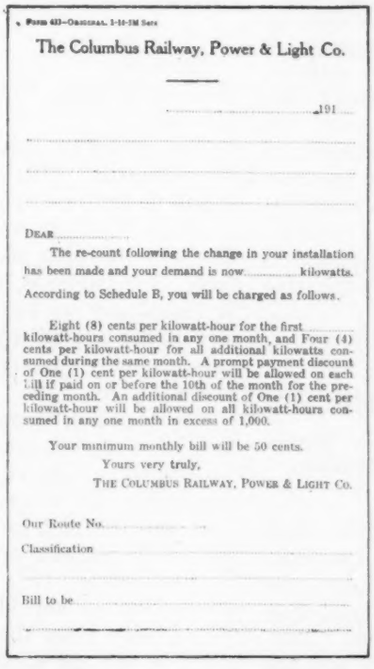
Yours very truly,

The Columbus Railway, Power & Light Co.

Our Route No.....

Classification.....

Bills to be.....



Form 453—Original. 3-16-3M Sets

The Columbus Railway, Power & Light Co.

.....,191....

DEAR.....

The re-count following the change in your installation has been made and your demand is now.....kilowatts.

According to Schedule B, you will be charged as follows.

Eight (8) cents per kilowatt-hour for the first..... kilowatt-hours consumed in any one month, and Four (4) cents per kilowatt-hour for all additional kilowatts consumed during the same month. A prompt payment discount of One (1) cent per kilowatt-hour will be allowed on each bill if paid on or before the 10th of the month for the preceding month. An additional discount of One (1) cent per kilowatt-hour will be allowed on all kilowatt-hours consumed in any one month in excess of 1,000.

Your minimum monthly bill will be 50 cents.

Yours very truly,

THE COLUMBUS RAILWAY, POWER & LIGHT CO.

Our Route No.....

Classification.....

Bill to be.....

INSTALLATION RECOUNT

LAMPS			MISCELLANEOUS			MOTORS		
UNIT	Nos.	K. W.	ITEMS	Nos.	K. W.	H. P. RATING	Nos.	K. W.
5 Watt			3 lb. Iron			One-sixteenth		
13 "			5 lb. "			One-tenth		
15 "			6 lb. "			One-eighth		
20 "			8 lb. "			One-sixth		
25 "			12 lb. "			¼		
40 "			18 lb. "			⅓		
50 "			24 lb. "			½		
60 "			Toasters			¾		
100 "			Radiators			1		
125 "			8" Fan			1½		
150 "			12" "			2		
167 "			16" "			3		
250 "			Ceil. "			5		
400 "						7½		
500 "						10		
						15		
						20		
						25		
1 Glower			X Ray Mach.			30		
2 Glower						35		
3 Glower			Rectifiers			50		
4 Glower						Elev.		
6 Glower			Rheostats					
D. C. Arc								
A. C. "			Welders					
Flaming Arc								
Cooper Hewitt								
Picture Mach.								
Tota			Total			Total		
Lt. K. W. Conn.			Pwr. K. W. Conn.			Demand		K. W.

REMARKS:

CUSTOMERS' RECORDS SYSTEM ADOPTED BY COLUMBUS CENTRAL-STATION COMPANY

STATE-WIDE PUBLICITY WORK SUCCESSFUL IN ILLINOIS

Presenting Public Utility Facts to Public by Means of Prepared Press Notices Praised by John F. Gilchrist

Generally publicity work which utilities have been doing in Illinois was characterized as quite successful by John F. Gilchrist, vice-president of the Commonwealth Edison Company, speaking before the Iowa Section, National Electric Light Association. The idea originated from the work which a number of public utility men, including Samuel Insull, did for the Illinois State Council of Defense. In this work it was found that the daily newspapers, and especially the "down-state" papers, were prone to accept and print material if it came to them in what they considered good shape mechanically, regardless of whether or not it exactly coincided with the editorial policy of the paper. News matter issued in the shape of bulletins, for instance, and prepared so that it was all ready to send to the printer, seemed to reach print in a large precentage of cases. Realizing this, the utility companies have organized the Illinois Committee on Public Utility Information and have begun to send news bulletins to 200

Illinois newspapers. The results thus far are justifying the effort. The eight bulletins on which returns have been received show that an average of 50 newspapers out of the 200 use material out of each bulletin.

Mr. Gilchrist in expressing his satisfaction with this work offered the Iowa association permission to use the same material as is being circulated in Illinois if it cared to undertake the distribution in Iowa.

THE COST-PLUS BASIS FOR STREET LIGHTING

Public Utilities Men Seem to See It with Growing Favor, Especially Where More Amicable Public Relations Must Be Sought

"Within a very short time I expect to ask our city council for a new street-lighting contract. The basis on which I should like to see it drawn is one of depreciation plus 8 per cent return on the investment plus cost of operation." In these words an important central-station executive summarized his thoughts on the modern street-lighting problem.

In arriving at his conclusions he had reviewed the unpleasant and generally unprofitable experiences of other companies in dealing with these municipalities concerning street-lighting. His conclusions were largely the result of planning ways and means to avoid the old mistakes. Street lighting, he argued, is sometimes the cause of a utility's success or failure, not so much on account of the actual profit or loss as on account of the city's suspicions of profit or loss. Placing the contract on a "cost-plus" basis saves the street-lighting situation from being complicated by a discussion of competitive plants.

DANGERS FOR UTILITIES IN DEPRECIATION THEORY

G. N. Webster Calls It Most Serious Menace to Wh ch Investors Are Exposed—Property Worth Millions Confiscated Through Doctrine

False methods of valuation as applied to public utilities have resulted in confiscation of hundreds of millions of dollars invested therein and their general adoption will result in confiscation of several billions more. This is the opinion expressed in a monograph entitled "Theoretical Depreciation—A Menace to the Public and the Investor," by George N. Webster of New York. In the writer's view failure to comprehend the unsoundness of these theories is the greatest menace confronting the investors in public service securities.

Mr. Webster characterizes as utterly fallacious the "cost less depreciation" method by which a certain sum is deducted from the value of a company's property because of theoretical "depreciation." The basis of this doctrine is the assumption that used property becomes uniformly less in value during the period of its alleged "life expectancy," starting with 100 per cent value and ending with zero value. The most sinister support of this theory comes from the socialists, who to gain their ends must bring all public utilities into public ownership. To accomplish this they attempt strangulation of the utilities to the point where the companies themselves will seek in public ownership relief from absolute bankruptcy.

Advocates of the depreciation theory have been beguiled by false analogies by which they liken a utility, with its millions of dollars of investment and its myriad of units to an article of furniture and believe that as the used table has lost some of its value, so the used railroad has lost some of its value; that rates should be based upon "value" so conceived, and that a *used* railroad should charge lower rates than a *new* railroad. This analogy is false because it assumes in respect of an instrument furnishing a service that its age affects the value of the service rendered and the price which should be charged therefor. But, Mr. Webster points out, a brand-new plant, divorced from its earning capacity, is only a heap of junk, whereas coupled with a legitimate earning capacity a second-hand plant in operation is worth substantially more than a new plant.

The depreciation theory disregards the facts that (1) the investment of the owners is in the plant as a whole; (2) the investment is made because it has to be made in order that the investors may render a perpetual service in accordance with their franchise; (3) the investment remains intact until it has been repaid in part or in whole, and (4) there has never been any agreement between investors and their patrons for repayment of any part of the investment in service.

The fixing of rates in accordance with the doctrine that age of equipment should determine value of service is absurd.

Why amortize investments in public utilities? asks Mr. Webster. They are growing, not shrinking, and it will be time enough to talk of amortizing investments in them when, if ever, there are signs of shrinking. The consideration of age does not enter into the question. The public is buying transportation or light, and it should pay uniformly for a uniform service regardless of the age of equipment. Between two plants age cuts no figure so long as uniformity in service capacity exists.

The so-called "depreciation" theory involves the creation of a useless reserve fund calculated to repay the investment at the end of the "life expectancy" of the equipment. A reserve of this kind is useless both to the company and to the public, since it adds nothing to the investment upon which it would be allowed to earn a return. It is not needed for repairs or upkeep, which are, or should be, a part of current expenses. Utility men know that such costs cannot be collected in advance for the obvious reason that the earnings for each year must bear the burdens of maintenance for that year. They know also that there is no justifiable ground to demand from their patrons rates sufficient to meet the expenses of the future.

The depreciation theory contradicts the very act of investing in public service companies. Such investments are made because the investors feel that the utility business is, above all, permanent. If it were not for this fact, there would be no public service, because no investor would risk his money in it. Already the depreciation propaganda has had marked effect on utility investors. Those already in are not going in any deeper, and those not in at all will stay out. Before there can be a change for the better, commissions and courts must be taught to realize that the property of the utilities must be safeguarded against the evils of this doctrine. They must be made to realize that there no such thing as "accrued depreciation" which in the end wipes out investment.

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Dynamotors and Wind-Driven Generators for Radiotelephony.—R. G. THOMPSON.—Electrical machines are described which were developed particularly for service in the war. In particular, the writer describes a single-armature, double-commutator, bipolar, ball-bearing, totally inclosed direct-current machine 5 in. (12.7 cm.) in diameter and 8½ in. (21.6 cm.) long, weighing approximately 15 lb. (6.8 kg.).—*Electric Journal*, May, 1919.

The Three-Wire Direct-Current Machine of Sengel's Type.—H. LORENZ.—For the direct-current, three-wire dynamo with three-phase voltage divider a formula is derived for calculating the average potential difference with unsymmetrical loading of the two halves of the network, and information is given regarding the connection arrangements of the transformer windings as well as the choice of the number of turns in the windings in the case of three-phase transformers for unsymmetrically arranged slip-ring connections.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau*, Feb. 25, 1917.)

Generation, Transmission and Distribution

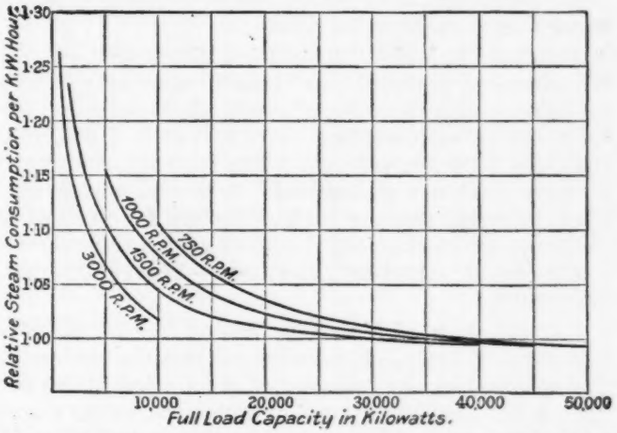
Parkersburg Station, Monongahela Valley Traction Company.—The feature of this large power-plant installation is the fact that a condenser pit is provided in which the circulating system operates as a siphon.—*Power Plant Engineering*, July 1, 1919.

Station Load and Economy.—T. NORBERG SCHULZ.—The writer presents a number of curves for the study of power plants with special reference to the determination of the load factor on the various machines to show what capacity of machines is necessary for steady load and what part of the generating equipment should be for peak loads.—London *Electrician*, June 20, 1919.

The Protective Value of Choke Coils.—E. PIFFNER.—The author investigates, mathematically and in detail, the relative merits of shunted choke coils and of iron-wire coils in protecting against surge voltages. Comparative tests between unshunted choking coils and others shunted with resistance show that the former are more effective in flattening the steep wave-front of surge pressures. The comparison shows also the practical equivalence of iron-wire coils and choking coils shunted by resistance, so far as concerns increased damping of the free oscillations. The constructional rule is confirmed that the distributed capacity of protective choke coils should not be too great, but should preferably be as small as possible. It is shown that protective choke coils, of the dimensions usual in practice, in conjunction with the usual protective condensers, cannot produce dangerous resonant voltages if no measures be taken to increase the damping. Finally, it is shown that shunt resistances, as a means for the partial elimination of injurious self-induction in current transformers and trip coils for small working currents, are effective in obviating injurious resonant overvoltages. With working currents exceeding 100 amp. the use of shunt resistances is generally superfluous.—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Elektrot. u. Maschinenbau*, March 4 and March 11, 1917.)

Operation of Overhead Distribution Systems.—C. E. SCHWENGER.—Under distribution systems the author considers secondary lines, transformers and primary lines. He discusses arrangement with special reference to economy of copper and voltage regulations.—Toronto *Electrical News*, July 1, 1919.

The Use of Large Turbo-Generators at Rotherham.—In connection with the recent expansion of power plants at Rotherham, England, to a total of 70,000 kw., which incidentally cost about $73 per kilowatt, the question



RELATIVE STEAM CONSUMPTION FOR TURBO-GENERATING PLANT

of increasing the size of generating units is discussed. In a plant being erected in this district the first installment is to consist of two 12,500-kw. turbo-generators, but the decision to erect a 30,000-kw. set has been regarded by some as venturous. It is said that while generating sets of from 30,000 kw. to 60,000 kw. are in use in America, there do not seem sufficient data at hand for stating just what the largest economical size for British practice may be. A set of curves, however, is offered showing the relative speed economy for different sizes of units at speeds of from 750 to 3000 r.p.m. and indicating that for very large sizes there is no great advantage in the highest speed.—London *Electrician*, June 27, 1919.

Flow of Steam Through Pipes.—A. STODOLA.—This article describes experiments on the forms of the stream lines of high-pressure steam flowing in pipes of various shapes. The experiments are based on observations with Pitot tubes at various distances from the axes of the pipes and at different positions along their lengths.—*Science Abstracts*, April 30, 1919. (Abstracted from *Zeits. Vereines Deutsch. Ing.*, Jan. 11 and Feb. 1, 1919.)

Fuel Problem of Canada—Some National and International Aspects.—ARTHUR V. WHITE.—While the extreme east and west of Canada supply coal to those sections of the United States immediately to the south, the middle provinces of Canada are dependent upon the United States for their fuel supply. Canada is therefore now taking active steps toward the development of the vast deposits of lignite in Saskatchewan and Alberta. For a number of years the writer has been actively advocating the further development of the great fuel resources of Canada in order to lessen her dependence upon the United States for coal.—*General Electric Review*, June, 1919.

Traction

Operating Without Telephones.—EDWARD DANA.—On account of the strike of telephone operators in New England in recent months a plan has been developed by the Boston Elevated Railway system whereby the cars may now be operated without the aid of the telephone.—*Electric Railway Journal*, July 5, 1919.

Discussion of Axle Generators and Pulleys.—The article is based on a discussion of a paper by Jack Lambert of the Pullman Company and a paper by Frank Weber of the Delaware, Lackawanna & Western Railroad. Some test data were presented.—*Railway Electrical Engineer*, June 19, 1919.

Standard Automatic Substation Equipment.—R. J. WENSLEY.—It is stated that standard apparatus is now available for the operation of six-phase, 25-cycle and 60-cycle, 600-volt self-starting converters of 300, 500, 750, 1000 and 1500 kw. capacity. The standard equipment of these machines is itemized. A typical wiring diagram is given, and the various devices for protecting the converter against possible damage due to abnormal conditions of operation are shown.—*Electric Journal*, May, 1919.

Electrification of Main-Line Railroads.—W. B. POTTER and S. T. DODD.—It is estimated that the equivalent fuel required by the railroads of the United States for one year is 140,000,000 tons, of which the writer states 100,000,000 tons could be saved by the electrification of these roads. In comparing the design of electric locomotives in this country with European locomotives, it is said that there is considerable difference in the method of transmitting the power of the motor to the driving wheels. In America the locomotive was a development from the heavy high-speed motor cars, whereas in Europe designers seem rather to have replaced the locomotive cylinder by the electric motor, retaining the side rods and other devices found on the steam locomotive. The practice in this country points to the continued use of geared motors mounted directly on the axle for freight and slow-speed passenger service. For high-speed passenger work the motors will presumably have some type of gearing or preferably be of gearless design.—*General Electric Review*, June, 1919.

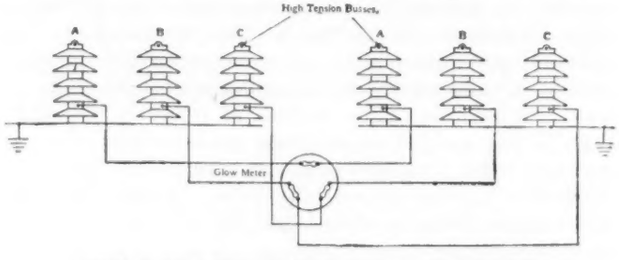
Installations, Systems and Appliances

Overload Protection for Electric Motors.—O. C. CALLOW.—A brief discussion of the different types of overload protection for motors which are in common use, showing their respective disadvantages and shortcomings and suggesting other and better arrangements to suit various conditions.—*Power*, July 19, 1919.

Electric Arc Welding.—F. A. ANDERSON.—The writer describes heavy work accomplished by arc welding, such as the welding of large flanges of pipe and the repair of heavy engine parts.—*Journal of American Society of Mechanical Engineers*, May, 1919.

Important Factors for Efficient Arc Welding.—E. WANAMAKER and H. R. PENNINGTON.—The writer states that there are two distinct methods for distributing power to arc-welding equipments—(1) the standard or existing power circuit may be used to furnish power to the individual equipments; (2) a separate circuit may be installed to furnish power at the proper value from a motor-generator set or other means operated from the main power circuit. The writer discusses the proper application of each of these systems. He also describes a considerable amount of accessory apparatus which has been found necessary for use in protection of eye and body.—*Railway Electrical Engineer*, June, 1919.

The Electrostatic Glow Meter.—R. J. WENSLEY.—The writer states that in high-tension switching stations where no wattmeters are used it is often desirable to have an indication of the presence of potential, of grounded phase or of synchronism between two separate high-tension lines. In the absence of potential transformers a simple device for securing these indications through the electrostatic discharge of one section of an insulator column has been developed by means of three small bulbs filled with gas, which have the property of giving forth a vivid orange red glow on an extremely small static discharge.—*Electric Journal*, May, 1919.



THE GLOW METER USED AS A SYNCHROSCOPE

Records and Maintenance of Aluminum-Cell Lightning Arresters.—F. S. PIPER.—To be assured that electrolytic lightning arresters will provide the greatest protection, it is necessary to charge them regularly, to measure the charging current frequently and to follow up the information obtained. The writer proposes a testing set for measuring charging currents and shows what records should be kept to indicate fairly the condition of the arresters.—*General Electric Review*, June, 1919.

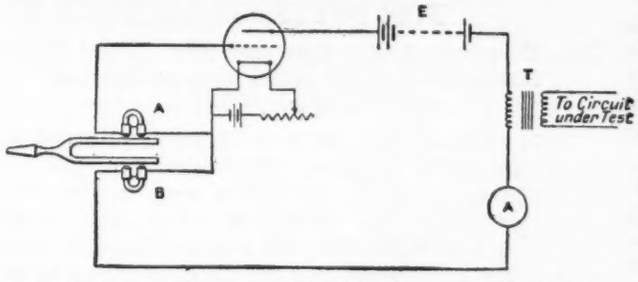
Large Electric Steel-Melting Furnaces.—VICTOR STOBIE.—The writer's experience with small and large electric arc steel-melting furnaces is that the latter are preferable for ingot making on account of the more advantageous costs and conditions of workings of large units. The smaller furnaces have a very large field in foundry work. The design of large furnaces is the subject of this paper in particular. The writer discusses wiring diagrams and shapes of furnaces and arc phenomena and states that the very high temperature of boiling carbon is not necessarily detrimental. He enumerates what the characteristics of transformers should be for use in connection with electric furnaces, gives the variations in power factor for different conditions of the melt and points out recent improvements

in bushings for the electrodes whereby the furnace operation is much improved.—London *Engineering*, June 6, 1919.

Electrophysics and Magnetism

Effect of an Electric Field on the Spectrum Lines of Hydrogen.—TOSHIO TAKAMINE and NOBORU KOKUBU.—This is the third paper of a series by the writers in which the effect of an electric field on the spectrum lines of helium and argon is studied, as well as the effect of hydrogen. The writers state that the only change in apparatus from that previously used is the use of a tantalum cathode instead of one of aluminum.—*Memoirs, College of Science, Kyoto Imperial University, Vol. III, No.* 9, March, 1919.

Sustaining the Vibrations of a Tuning Fork by a Triode Valve.—W. H. ECCLES and F. W. JORDAN.—It is well known that oscillations of acoustic frequency are easily produced continuously by including a suitable



TUNING-FORK IMPULSES CONTROLLED BY MEANS OF THREE-ELECTRODE VALVE

inductance and capacitance in a triode tube in any of the retroactive connections familiar in wireless telegraphy. For this purpose rather large inductances and capacitances are required, and the set-up is therefore rather costly and bulky. Consequently it is sometimes desirable to use an alernative method. Such a method can be arrived at by replacing the inductance by mechanical inertia and the capacitance by the elasticity of matter. For example, if a tuning fork is so arranged that two electromagnets act upon its prongs, one being in the plate circuit and the other in the grid circuit of the triode, the movement of the grid prong induces emf. in the grid coil, and this controls the plate current, which, in its turn, on traversing the plate magnet in the correct sense, sustains the motion of the fork. The arrangement is shown diagrammatically in the figure, which explains itself.—London *Electrician*, June 20, 1919.

Telegraphy, Telephony and Signals

Quantitative Experiments with Coil Antennas in Radio-telegraphy.—I. W. AUSTIN.—The writer derives equations that show that, other things being equal, if antennas be used both for sending and receiving, the received current falls off as the wave length, while if one coil be used, it falls off as the square of the wave length and with two coils as the cube of the wave length. Test data were obtained at the Arlington station using coil antennas.—*Journal Washington Academy of Science*, June, 1919.

The Nauen High-Power Wireless Station.—E. QUACK.—The author gives an account of the changes undergone by the Nauen station as a result of the necessity of providing increased power, etc., on account of war requirements after Germany found herself cut off from cable communication with the outer world. At the beginning of 1914 the station made use of 100 kw. in the antenna, with a musical quenched spark obtained from a high-frequency alternator employing the frequency-doubling method with static transformers. The difficulty of the radiographically unfavorable months rendered it necessary to increase the power of the Nauen station. The new installation at Nauen consists of an extensive antenna system, with a large building for the plant and apparatus. A certain number of details are given of the plant and arrangements, but a full description is kept back for military reasons. The antenna energy has been raised to 400 kw. and two antenna systems are provided. The larger system is a T-antenna and can be supplied with 600 kw. The smaller system has the shape of a horizontal triangle, the energy (up to 200 kw.) being supplied to the apex. Its mid line is arranged so as to be at right angles to the large antenna, and in this way, owing to the coupling between the two systems being a minimum, simultaneous transmission with two different waves is possible, while the provision of two independent antenna systems assures the continuity of the service in case of a breakdown of one system. The two masts, of lattice construction, are 260 m. high and are bedded on an insulating ball at the base, there being another insulating link at 150 m. from the ground. The special insulators placed in the guy ropes and capable of withstanding a pull of 650 tons are described. The alternator is single-phase of 800 hp. and has a frequency sufficiently high for it to yield, after several stages of frequency doubling, 24,000 cycles per second, corresponding to a wave length of 12,500 m. The transmitting key is arranged for operation at 200 letters per minute. The efficiency of the installation, from energy input at driving motor to antenna energy, is stated to be about 65 per cent at 12,000 m. wave length. The following comparative figures are given:

	1908	1918	
		Large Antenna	Small Antenna
Masts	One of 100 m.	Two of 260 m.	Two of 150 m.
		Four of 120 m.	One of 135 m.
Antenna areas	31,000 sq.m.	155,500 sq.m.	77,500 sq.m.
Primary output	50 kw.	600 kw.	175 kw.
Antenna energy	12 kw.	400 kw.	100 kw.
System, slow sparking		H.f. alternator	Quenched spark
Range, 3600 km		20,000 km.	800 km.

—*Science Abstracts, Section B*, April 30, 1919. (Abstracted from *Jahrb. d. Drahtl. Tele.*, 13, 1919.)

Miscellaneous

Safety Rules for Men Handling Electrical Circuits or Apparatus.—The safety rules set forth in this article are based on the long experience acquired in the electrical field by the General Electric Company and have been carefully prepared for the use of its own employees. They are published for the purpose of permitting others interested in such rules to make comparisons.—*General Electric Review*, June, 1919.

Surplus Electric Power After the War.—J. W. BECKMAN.—The writer states that when the manufacture of special war material has diminished there may be a surplus of electrical generating capacity which should be used in supplying work for many of the men returning from the army. He urges particularly that manufacturing for export purposes be pushed, along with commercial organizations for securing the markets.—*Proceedings American Electrochemical Society*, Atlantic City, Oct. 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DAYLIGHT-SAVING REPEAL ACT PASSED BY SENATE

Measure Is Again Before President, and It Is Predicted that the Repealing Act Will Once More Meet with His Veto

The Senate last week, by a vote of 41 to 12, passed the bill (H. R. 3854) repealing the daylight-saving law, despite the fact that this same measure was recently vetoed by President Wilson. Senators favoring the act of 1918 predicted that the measure would again be vetoed by the President. The separate House bill was passed June 18, but action in the Senate was suspended until last week, and in the interim the President vetoed the rider in the agricultural bill and the House was unable to enact it over the veto.

The bill which was passed differs from the rider in the agricultural bill in that it does not do away with the provisions regulating standard time. Some Senators seemed to think that the President vetoed the rider because of the interference with standard zones of time. The President, however, stated that he was not in favor of repealing a measure that was proving a benefit to the country.

Senator Calder pointed out that the matter had been voted upon by the House four separate times during the present session of Congress.

ECONOMY FROM PACIFIC COAST POWER CONSOLIDATION

Northern California Properties Will Be Developed by Purchaser So as to Realize Maximum Savings from Acquisition

In connection with the recent purchase of the Northern California Power Company by the Pacific Gas & Electric Company, A. F. Hockenbeamer, vice-president and treasurer of the latter company, has issued a statement concerning the acquisition. The gross earnings of the Northern California Power Company show quite a satisfactory growth of 51 per cent during the last fiscal year, but no detailed analysis of the possible economies to be effected through the consolidation has yet been made. An office investigation made by the engineers of the Pacific Gas & Electric Company, however, indicates that a saving of $50,000 a year is easily possible.

The Pacific Gas & Electric Company anticipates the expenditure of considerable money to bring the property up to its own standard of physical condition, and it is felt that with its greater resources of organization and capital the development and earning capacity of the acquired property will be accelerated.

In addition to the work on the acquired Northern California properties, the Pacific Gas & Electric Company has made definite plans for carrying out the construction of a hydroelectric plant at Belden, on the North Fork of the Feather River. The new station, which will utilize the flow of Yellow Creek, will involve an expenditure of approximately $5,000,000, and work on a large scale will begin soon. The plant is to be completed during the next two years and will develop 30,000 kw.

INCREASED POWER SUPPLY FOR PITTSBURGH DISTRICT

The Duquesne Light Company Has Under Way a Power Plant at the Mines with an Ultimate Output of 300,000 Kw.

It is expected that the new Cheswick plant of the Duquesne Light Company, Pittsburgh, Pa., the construction of which is now under way, will be completed within a year. While the initial rating of the station will be 60,000 kw., the construction now under way is for 120,000 kw. and the ultimate rating of the plant will be 300,000 kw. According to the officials of the company, the demand for power in Pittsburgh and surrounding districts is such that if the plant were completed at present contracts for the entire output could be made at once.

In constructing the Cheswick plant the company is following out a conservation plan strongly advocated during the war, that of having power plants located adjacent to coal mines and thus saving a long haul on fuel required. The Cheswick plant is within a few miles of a coal mine owned by a subsidiary company, and fuel is transported over a privately operated railroad. Dwight P. Robinson & Company, Inc., constructing and consulting engineers of New York City, have been awarded the contract to design and construct the power station with the necessary complement of boilers, piping, electrical apparatus, coal-handling devices, coal storage, etc.

ELECTRICAL ASSOCIATION MEETINGS IN SEPTEMBER

Nine Important Conventions Will Be Held During the Coming Month in Widely Separated Sections of the Country

In the month of September nine electrical associations will hold annual conventions. Three of these meetings will be held on the Pacific Coast, two in the Middle West, one in the South and three in the East. The following is a list of the dates and meeting places:

Sept. 3 to 6—Bedford Springs, Pa. Pennsylvania Electric Association.

Sept. 10 to 12—Seattle, Wash. Northwest Electric Light Association.

Sept. 17 to 19—Los Angeles, Cal. Pacific Coast convention of A. I. E. E.

Sept. 17 to 19—Asheville, N. C. Southeastern Section of N. E. L. A.

Sept. 16 to 18—New London, Conn. Association of Edison Illuminating Companies.

Sept. 18 to 20—Glenwood Springs, Col. Colorado Electric Light, Power & Railway Association.

Sept. 22 to 24—New London, Conn. New England Section, N. E. L. A.

Sept. 22 to 26—St. Louis, Mo. Association of Iron and Steel Electrical Engineers.

Sept. 23 to 26—Chicago, Ill. International Association of Municipal Electricians.

N. E. L. A. ADMINISTRATION COMMENCES ACTIVE WORK

Chairmen of Committees Are Appointed, and Various Sections Are Making Reports on Proposed Activities

The details of the first meeting of the executive committee of the new administration of the National Electric Light Association, held July 10, have just become available. In the absence of President Ballard, Vice-president Martin J. Insull presided. Everett W. Burdett was reëlected general counsel. While a number of the national standing committees have been appointed and the appointments confirmed by the executive committee, the personnel of several of the committees has not yet been completed. The chairmen of the committees are as follows: Accident prevention, Charles B. Scott; company section, Frank A. Birch; constitution and bylaws, W. C. L. Eglin; Doherty and Billings prizes, A. S. Loizeaux; exhibition, C. L. Pierce, Jr.; finance, Joseph B. McCall; lamp, Frank W. Smith; membership, Walter Neumuller; class C membership applications, Walter Neumuller; public policy, John A. Britton; rate research, Alex Dow; relations with educational institutions, John F. Gilchrist; safety rules, W. C. L. Eglin.

ACTIVITIES CONTEMPLATED

Mr. Insull read a letter from President Ballard outlining plans for the year's work and suggesting the following as subjects which might be considered: Electrical resources of the nation, electrification of steam railroads, rules of regulatory bodies, public information, employees' participation.

In connection with the subject of electrical resources of the nation, the committee called attention to the fact that both the Department of the Interior and the War Industries Board have compiled data relating to this question and that it might be well to appoint a committee to bring together all of the data and material on the subject collected by different bodies and put them in shape for the central stations to use in the most advantageous manner.

It was announced that the Technical Section had reappointed the committee on electrification of steam railroads, which was discontinued several years ago, and that Peter Junkersfeld would serve as chairman. Mr. McClelland stated that statistics as to the savings effected by electrified roads should be collected and publicity given to them. It was also suggested that a national committee might be appointed on this subject to work in conjunction with the Technical Section committee. Mr. McClelland said that the National Industrial Conference Board has been doing a great deal of work on the subject of employees' participation, and that if the association appoints a committee to study this question it should utilize the data collected by the board.

President Ballard's letter regarding the year's work also covered the representation of the association at all geographic section conventions and other electrical conventions. In his letter President Ballard stated that he hoped to attend the conventions of the New England Section and the Southeastern Section in the last half of September.

TECHNICAL SECTION REPORT

Chairman Moultrop of the Technical Section reported that his executive committee had held an all-day meeting on July 9, at which time the committees were appointed, the work of each being outlined and their meetings scheduled for the next twelve months. In order to enable the Western committee members to attend, the meetings will be held as far west as possible, one or two being scheduled for Denver. By the appointment of O. B. Coldwell of Portland, Ore., as a member of its executive committee, the Technical Section now has a representative from both the Northwest and the Southwest, H. A. Barre, of Los Angeles, also being a member.

Mr. Moultrop reported that in compliance with a request received from R. S. Hale, chairman of the wiring committee, he is arranging for technical representation on that committee. He also reported that the committee on overhead lines and inductive interference has been divided into two committees. with W. K. Vanderpoel as chairman of the overhead systems committee and A. E. Silver as chairman of the inductive interference committee, both committees to report to R. J. McClelland.

Vice-president Bump stated that at the request of President Ballard he had been studying the geographic section situation, and had hoped to be able to recommend a specific plan for adoption at this meeting, but that the work would require more time. He suggested the appointment of a committee to make a report to the executive committee at its next meeting on a definite division of the states into geographic sections. Vice-president Insull thereupon appointed the following committee: R. J. McClelland, chairman; H. E. Brandli, J. E. Davidson, L. D. Gibbs, Robert Lindsay, E. W. Lloyd, O. H. Simonds and F. M. Tait.

ACCOUNTING SECTION REPORT

Chairman Symes of the Accounting Section reported that one meeting of his executive committee had been held at which time the committees for the year were considered and some of the less active ones discontinued. The committee on accounting relations with other associations was merged with the committee on classification of accounts, and the committee looks for marked progress in the national standard classification of accounts.

Chairman Symes also reported to the effect that four new committees had been added on bonus system, federal income-tax-return procedure, credits and collections, and insurance. Practically all of the chairmen have accepted appointments and the section activities are proceeding in good shape. Mr. Symes stated that he had communicated with Chairman Learned of the Commercial Section in the matter of having representatives

of the Commercial Section on some of the accounting committees.

COMMERCIAL SECTION REPORT

For the Commercial Section Chairman Learned reported that activities are well under way. The committees have been appointed, and some are already functioning. The general plan is to handle the work of the section through four main bureaus, namely, Power Sales Bureau, Lighting Sales Bureau, Merchandise Sales Bureau, Advertising and Publicity Bureau. In addition to these four divisions there will be the committees on salesman's handbook, education of salesmen, commercial service and relations with customers, compensation of salesmen, finance, and the following two new committees: committee on relations with geographic sections, company sections and state electric associations and committee on relations with contractors, dealers and jobbers. It is planned that representatives of this latter committee shall attend all state and national meetings of contractors, dealers and jobbers.

ELECTRIC VEHICLE SECTION REPORT

For the Electric Vehicle Section Chairman Foster reported that the section was considering appointing an advertising man, but that if a publicity man were engaged for the association this might not be necessary. Mr. Foster stated that as a result of some recent cooperation in Chicago the electric garages have been able to effect considerable saving in insurance premiums and have also been made agents for the insurance companies, thus enjoying commissions on this work. He reported that the transportation engineering committee is now conducting correspondence with 155 colleges in the matter of developing further transportation engineering courses and is compiling a list of electric truck users to whom questionnaires are to be mailed to obtain operating cost data, etc.

Mr. Foster also spoke of the indifference of central-station employees toward the electric vehicle, and said that it was hoped to overcome this feeling by the publication of articles in the *Bulletin* and other ways. He also mentioned the great benefits that might be derived from what he styled a spectacular campaign to introduce electric vehicles, suggesting the possibility of selling them to some city for use in its departments generally, with the particular object of giving wide publicity to such a sale.

PERSONNEL OF N. E. L. A. PUBLIC POLICY COMMITTEE

John A. Britton of San Francisco Has Accepted Chairmanship and Will Be Assisted by Prominent Central-Station Operators

In submitting to the executive committee his appointments to the public policy committee President Ballard of the National Electric Light Association stated that he had prevailed upon John A. Britton of the Pacific Gas & Electric Company of San Francisco to accept the chairmanship of the public policy committee for the ensuing year. W. W. Freeman of Cincinnati has consented to act as vice-chairman, thus facilitating the work of the committee, and S. Z. Mitchell of the Electric Bond & Share Company has been added, thus tying in the great organization over which he presides more intimately with association affairs. The other members of the committee are: R. H. Ballard, Southern California Edison Company, Los Angeles (ex officio); N. F. Brady, New York; H. G. Bradlee, Stone & Webster, Boston; E. W. Burdett, Boston; Walton Clark, United Gas Improvement Company, Philadelphia; Henry L. Doherty, New York; Charles L. Edgar, Edison Electric Illuminating Company of Boston; Samuel Insull, Commonwealth Edison Company, Chicago; John W. Lieb, New York Edison Company; Joseph B. McCall, Philadelphia Electric Company; Thomas E. Murray, New York Edison Company, and H. A. Wagner, Consolidated Gas, Electric Light & Power Company of Baltimore.

OVERHEAD SYSTEMS COMMITTEE TO REVISE SPECIFICATIONS

Assistance of Operators in the Industry Solicited in Bringing to Light Valuable Constructive Data and Suggestions

The overhead systems committee of the National Electric Light Association, formerly called the overhead lines committee, has sent out a request for cooperation in its work this year. The committee plans to bring up to date the descriptions, specifications and other matter previously published relating to overhead-line construction. Information will be compiled regarding recent experience and new practices, with especial attention to any innovations and other features developed during the war period.

To make this work complete, the committee asks active assistance and will appreciate any information which would be useful to the industry. Suggestions are also invited on any features which should be developed in the committee's next report. It is requested that matter of this kind be presented in sufficient detail to permit the committee to work to the best advantage in securing the desired information.

It is also suggested that the previous reports of the committee be reviewed in order to determine the character of the recommendations and information still required. If such attention is paid to the subject, it is said that the committee's activities will be guided by the real necessities of the industry, and there will be a greater production of valuable constructive data, without repetition of information already available.

It is hoped in this way not only that the work of the committee will be facilitated but that those interested will avail themselves of the opportunity to make use of the committee by indicating the kind of assistance they desire.

GOVERNOR OF MAINE NAMES WATER-POWER COMMISSIONERS

Conservation of Resources and Expediency of State Ownership of Facilities Are to Be Investigated by Appointees

Governor Milliken of Maine has appointed the following commissioners to conduct an investigation of water-power resources in the state and to report to the next Legislature upon the feasibility of state development and ownership of hydroelectric facilities: Chairman, E. P. Ricker, Poland; Arthur Chapin, Bangor; Byron R. Bradbury, Portland; Alfred K. Ames, Machias; Artemus Weatherbee, Lincoln; Edward Evans, State

Grange; Frank Partridge, Waterville; William J. Crawshaw, Auburn; Charles F. Flagg, Portland. The commissioners represent citizens at large, the State Senate and House, labor and other interests.

NEW JERSEY COMMISSION ABROGATES RATE SURCHARGE

Investigation, It Is Claimed, Has Shown Revenue Greater than Anticipated, and Sound Public Policy Required Reduction

The Board of Public Utility Commissioners of New Jersey has ordered the Public Service Electric Company to abrogate the war surcharge of 25 per cent for electric service supplied to customers under a uniform retail power rate, effective Sept. 1. The permission to make this extra charge was granted by the board in 1918. In accordance with the present decision, the surcharge will continue in force until further notice so far as applies to the rates for wholesale power, and it is set forth that unless the company agrees to this modification of the surcharge order the entire surcharge will be set aside pending further action.

This action of the commission is the result of a series of investigations in which it has been found that the war surcharge, excepting in the case of wholesale power, has brought a revenue in excess of that anticipated when the application was granted of $1,800,000. The annulment of this charge will affect about 10,000 consumers, or approximately 95 per cent of the power customers of the company. In the matter of wholesale power the commission finds that the rates are proportionately lower than for other classes of service. In its decision the board says:

It becomes a matter for the board to determine a sound public policy, rather than a determination of the accuracy of financial estimates in making modifications of existing rates. In a period of readjustment public policy requires that the greatest care be exercised, first, that the utility be not made the victim of too optimistic forecast and its revenues so curtailed that, in the event of unforeseen conditions, it shall be so crippled as to preclude the performance of its proper functions; second, on the other hand, in a period of readjustment the public should be protected against prohibitive war rates, particularly where it is disclosed that from the results of operation thereunder an excess amount has been earned by the utility. The surcharge heretofore allowed cannot be removed entirely, as to do so would result in an actual deficit of several hundred thousand dollars, dependent upon the readjustments now taking place in the industries. The board is of the opinion that the removal of the surcharge entirely from the bills charged to the customers under the uniform retail power rate and the rate for elevator service, and the continuance thereof on the rates of the wholesale power customers, refrigerator rate and kilowatt-hour rate, will result in a sufficient net revenue to the company to assure the continuation of safe, adequate and proper service to the public, and to enable it properly to market its securities and thereby finance extensions.

GOVERNMENT IN NEED OF ELECTRICAL ENGINEERS

Positions Are Open for Electrical Men in Different Kinds of Work, Both in Ordnance Department and Signal Service

The United States Civil Service Commission has announced for Sept. 2, 1919, competitive examinations for electrical men to fill vacancies as mentioned below:

For vacancies in the Ordnance Department at large of the War Department, for duty at ordnance establishments throughout the United States — Plant superintendent at $2,000 to $2,400 a year; research physicist at $2,700 to $3,200 a year; mathematics and dynamics experts at $2,500 to $5,000 a year.

For vacancies in the Signal Service at large of the War Department—Radio engineers at $3,000 to $4,000 a year; radio laboratory assistants at $800 to $2,000 a year; specification engineer at $2,000 to $2,400 a year (apply on form 1312 before Sept. 9, 1919); electrical engineers at $1,800 to $3,600 a year (apply on form 2118 before Sept. 16, 1919).

For vacancies in the Bureau of Standards, Department of Commerce, for duty in Washington—Electrical engineers qualified in electrical safety work; the salary ranges from $2,800 to $3,300 a year.

For all positions except those of plant engineer and specification engineer application should be made for form 2118, stating the title of examination desired. In the case of the position of plant engineer and specification engineer form 1312 must be requested. Application forms must be filled out and mailed before Sept. 2, 1919 (except as otherwise noted in the lists of positions), to the Civil Service Commission at Washington, D. C., or to the secretary of the United States Civil Service Board at the custom house in Boston, New York, New Orleans or Honolulu, or the post office in Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, Seattle or San Francisco, or the old custom house, St. Louis; Administration building, Balboa Heights, Canal Zone, or the chairman of the Porto Rican Civil Service Commission, San Juan, P. R.

Outing of New England Electrical Men at Summer Resort

The above photograph was taken at an outing of the N. E. L. A. Company Section of the Worcester (Mass.) Electric Light Company with electrical contractor-dealers at Point Breeze, Webster Lake, Mass.

The Magician

From out of the old village there grew the struggling factory, and industrial science developed the greatest of modern achievements—a world of power plants.

—From the Daily published by the ELECTRICAL WORLD *at the Atlantic City Convention of the N. E. L. A.*

CONVENTION OF NEW ENGLAND SECTION OF THE N. E. L. A.

Details of Program for Annual Meeting on Sept. 22 to 24—All Pre-War Features Are Again Included in the Scheduled Features

For the eleventh annual convention of the New England Section of the National Electric Light Association, which will be held at New London, Conn., Sept. 22 to 24, the Hotel Griswold has been selected as headquarters. Entertainment features of pre-war times will be restored. The tentative program follows:

Monday, Sept. 22, 10 a.m.—President's address, George B. Leland, Stamford Gas & Electric Company, Stamford, Conn. Treasurer's report, Bowen Tufts, C. D. Parker & Company, Boston. Secretary's report, Miss O. A. Bursiel, Boston. Standing committee reports: Advertising and publicity, L. D. Gibbs, chairman, Boston; accident prevention, H. W. Moses, chairman, Boston; membership, Merle R. Griffith, chairman, Boston. "The Purchase of Coal," by Perry Barker, Fuel Engineer, Boston. "High-Power Switching Apparatus Used in Connection with Large Systems," by Fred L. Hunt, Turners Falls Power & Electric Company, Greenfield, Mass.

Monday, Sept. 22, 2 p.m.—Session in charge of and assisted by members under forty years of age; chairman, F. A. Belden, Rockingham County Light & Power Company, Portsmouth, N. H.; assistant chairman, Leavitt L. Edgar, Edison Electric Illuminating Company of Boston. (Topics not yet announced.)

Tuesday, Sept. 23, 10 a.m.—Commercial session; Commercial Section committee report, C. E. Greenwood, chairman, Boston. (To be followed by discussion of commercial subjects.)

Tuesday, Sept. 23, 2 p.m.—Commercial session—"The Use of the Electric Range in a Small City," by E. F. Putnam, Connecticut Light & Power Company, Greenwich, Conn.; "Electric Ranges and Water Heating," by M. C. Osborn, Landers, Frary & Clark, New Britain, Conn.

Tuesday, Sept. 23, 7 p.m.—Dinner. This occasion will be similar in dignity and importance to previous banquets. Dinner will be followed by public policy session—A. B. Lisle, chairman public policy committee, Providence, R. I.; address by R. H. Ballard, president National Electric Light Association, Los Angeles, Cal. "Municipal Ownership and Socialism," by F. G. R. Gordon, Boston. Representatives of New England public service commissions as guests.

Wednesday, Sept. 24, 10 a.m.—"High-Tension Cables," by Wallace S. Clark, General Electric Company, Schenectady, N. Y. (Followed by discussion by operating men.) "The Control and Improvement of Power Factor," by Nicholas Stahl, Narragansett Electric Lighting Company, Providence, R. I. (Followed by discussion by operating men.) "Planning for Power as Applied to New England," by Prof. Charles F. Scott, Sheffield Scientific School, New Haven, Conn.

Wednesday, Sept. 24, 2 p.m.—Accounting Section committee report; Frederick E. Webster, chairman, Haverhill, Mass. Electric vehicle committee report, Day Baker, chairman, Boston. Annual meeting class A members; election of officers.

ASHEVILLE MEETING OF THE SOUTHEASTERN SECTION, N. E. L. A.

Three-Day Meeting at North Carolina Resort to Discuss Operating, Commercial and Public Policy Matters of Companies in Five States

Battery Park Hotel will be the headquarters of the annual convention of the Southeastern Section of the N. E. L. A., to be held at Asheville, N. C., Sept. 17 to 19. The mornings of the three days will be devoted to business matters presented through reports and papers, while the afternoons will be given over to entertainment and sight-seeing in the attractive surroundings of the city of Asheville. President R. H. Ballard of the parent association will attend this meeting and deliver a special address on Thursday morning, Sept. 18. This is an important meeting for Southern central-station men, including operators, commercial men and managers, for it gathers together for general discussion the problems experienced in the five states which the section embraces.

NEW DATES FOR CONVENTION OF MICHIGAN SECTION, N. E. L. A.

Interesting Program on Commerical and Operating Topics for Three-Day Meeting at Ottawa Beach, Mich.

The new dates set for the convention of the Michigan Section of the N. E. L. A. are Aug. 26 to 28, one week later than originally planned. Headquarters will be at the Hotel Ottawa, Ottawa Beach, Mich. The convention committee reports that the postponement has been made necessary owing to an unprecedented demand for summer resort accommodations.

The following program has been arranged:

Aug. 26, Morning Session.—Address by President Thomas Chandler; address, "New Public Utilities Bill," by James V. Oxtoby of the Detroit Bar; paper, "More Favorable Policy Toward Consumers," by John Swanson, district manager Consumers' Power Company; paper, "The Central Station and the Contractor-Dealer," by R. A. Gordon, Houghton County Electric Light Company.

Aug. 26, Afternoon Session.—Paper, "Commercial Lighting," by J. F. Mayo, Consumers' Power Company; paper, "Practical Phases of Industrial Lighting," by H. H. Magdsick, engineering department National Lamp Works.

Aug. 26, Special Evening Session.—Paper, "Safety," by Harry Burton, instruction department Consumers' Power Company; moving-picture film, "The Queen of the Waves" (two-reel educational film showing progress of electricity in navigation, by courtesy of General Electric Company; illustrated talk by W. A. Durgin of Commonwealth Edison Company, Chicago, Ill., on "Industrial Illumination."

Aug. 27, Morning Session.—Paper, "Appliance Sales in the Detroit Edison Company's Suburban Districts," by A. H. Touscany; paper, "Electrical Merchandising," by H. H. Koelbel, Consumers' Power Company; paper, "Domestic Refrigeration," by E. J. Copeland, Kelvinator Corporation, Detroit, Mich.; paper, "Electric Ranges, Their Sale and Operation," by R. F. Hotton, Detroit Edison Company.

Aug. 27, Dinner.—Address, "Municipal Ownership," by F. G. R. Gordon, Boston, Mass.; entertainment as arranged by the committee.

Aug. 28, Morning Session.—Paper, "Insurance," by J. H. Lobban, Detroit Edison Company; paper, by J. A. Cavanaugh.

PACIFIC COAST CONVENTION OF THE AMERICAN INSTITUTE

Meeting at Los Angeles to Be Held Under Auspices o Local Section—Vice-president Fisken to Preside

At Los Angeles, Cal., Sept. 18 to 20, the Pacific Coast convention of the American Institute of Electrical Engineers will be held under the auspices of the local section. John B. Fisken, vice-president of the Institute and chief engineer of the Washington Water Power Company at Spokane, Wash., will preside at the convention sessions.

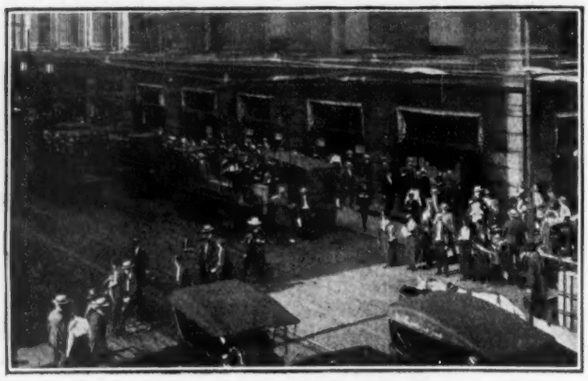
The tentative program includes the following papers; others will probably be added: "Order and Amplitude

of Harmonics in Voltage Wave Forms with Indicating Instruments," by Leslie F. Curtis, assistant professor of electrical engineering, University of Washington, Seattle, Wash.; "Theory of Probabilities Applied to Failures of Suspension Insulators," by L. M. Klauber, superintendent of electrical department, San Diego (Cal.) Consolidated Gas & Electric Company; "Predetermination of Synchronous Phase-Modifier Performance," by Hubert V. Carpenter, dean mechanical arts and engineering, State College of Washington, Pullman, Wash.; "Operating Features of a 1000-Mile, 220,000-Volt Transmission Line," by R. W. Sorrenson, professor of electrical engineering, Troop College of Technology, Pasadena, Cal.; H. H. Cox, station chief, Eagle Rock station, Southern California Edison Company, Los Angeles, Cal., and G. E. Armstrong, protection engineer, Southern California Edison Company, Los Angeles.

ORGANIZING TO BEAT A STREET-RAILWAY STRIKE

How the Commonwealth Edison Company of Chicago Took Care of Its Operating Force When Street-Car Service Was Crippled

Some departments of the Commonwealth Edison Company experienced a high percentage of absentees on the first day of the recent traction strike in that city. However, by the end of the second day of the strike the absentee percentage had returned to normal owing to rapid and efficient organization of motor-truck transport service to haul employees. The strike was called on Monday night, July 21. The transportation department of the company at once collected all of the company's chauffeurs. After this the first concern was for the handling of the station operating force. Eleven trucks were assigned to the duty of transporting the various shifts of this department. About thirty trucks, operating on ten regular routes, handled the employees in the general down-town offices and stores. Departments like those of service and repair and the underground departments, which had trucks of their own, handled their own problems. The practice of issuing truck transportation passes only to those employees who lived more than one mile from a steam railroad or other operating transportation system greatly simplified the work.



GETTING TO AND FROM WORK DESPITE STREET-CAR STRIKE

About 500 employees out of the total 5500 were handled daily by means of the trucks. Electric trucks which were used to carry employees in addition to doing as much as possible of their regular work got along well by taking an afternoon boosting charge.

England's Electrical Development Movement

Tel.: Hol. 253.

E.D.A

The Electrical Development Association

(Great Britain and Ireland).

HAMPDEN HOUSE,
84, KINGSWAY,
LONDON, W.C.2.

J. W. BEAUCHAMP,
Director and Secretary.

Associations of Supply, Manufacturing, and Contracting Interests represented on Managing Committee:

The Institution of Electrical Engineers.
The Incorporated Municipal Electrical Association.
The Conference of Chief Officials of London Electric Supply Companies.
The Incorporated Association of Electric Power Companies.
The British Electrical and Allied Manufacturers' Association, Inc.
The Electrical Contractors' Association.
The Cable Makers' Association.
The Electric Lamp Manufacturers' Association.

The Electrical Development Association has been formed on a co-operative basis to carry out Publicity and Propaganda Work on behalf of the Electrical Industry. Its Committee of Management is representative of the three sections—Supply, Manufacturing, and Contracting—which jointly provide the *Service of Electricity* to the consumer.

The Association will be glad to receive correspondence from Authorities, Firms, and persons interested in the supply or use of electricity and electrical apparatus, and the application of electrical methods to industrial, business and domestic purposes.

Enquiries are invited from Associations and individuals using or interested in the use of electricity for any purpose, and any information and assistance possible will be gladly rendered.

England has followed the example of this country in forming an association to develop electrical markets. The English brother of the Society for Electrical Development, Inc., of the United States had the accompanying announcement in a recent issue of the London *Electrician*.

LOW WATER ON THE COAST CAUSES POWER SHORTAGE

Irrigation Greatly Hampered by Shortage of Water Also, and Extra Load Is Thrown on the Public Utilities

With demands of industries and public utilities in northern and central California upon hydroelectric systems greater than last year, and with streams lower than last year, the immediate power future is viewed with concern by power users. The situation outlined in the ELECTRICAL WORLD of July 19, page 145, has not been changed with relation to California, but the temporary shortage of water has placed an unusual burden on public utilities of Idaho. In order to supply sufficient energy to permit the farmers to pump water, provision was made for temporarily curtailing commercial and city lighting service, if necessary. The shortage was due in a measure to the fact that a new power station of the Idaho Power Company was not completed in the time anticipated, but the station is now running, and the power shortage has been obviated in the Boise district. The latest advices are that the power situation in Idaho is now well under control.

DATA ON CENTRAL-STATION AND MUNICIPAL PLANTS

Tabulation Showing Number of Operating Companies and Details of Service Arranged by States

According to the summary which appears in the 1919 edition of the McGraw Central Station Directory and Data Book, which will soon be ready for distribution, there are 5543 operating companies furnishing electric service in the United States, an increase of 333 companies over 1918. This figure represents the names of companies operating generating stations (private and municipal), but it does not include the generating stations and substations that are listed under the cities these operating companies serve. Of these there are 1700 additional.

STATE	Total number of cos. private and munic.	Number of cos. generating	Number of cos. purchasing energy	Number of munic. ltg systems	Number of munic. systems purchasing energy	Hydro-elec plants in whole or in part	Number of new in this issue	Number having day service	Number retailing elect. appliances	Number doing elect contg.
Alabama	63	60	3	33	2	10	2	42	35	11
Alaska	12	12	0	0	0	7	1	10	9	5
Arizona	30	27	3	2	1	8	6	23	17	7
Arkansas	79	75	4	19	0	3	7	50	46	26
California	91	59	32	19	12	86	1	68	49	19
Colorado	60	47	13	11	1	28	1	47	43	17
Connecticut	39	30	9	3	1	17	0	33	24	5
Delaware	12	9	3	6	0	0	0	6	6	4
District of Columbia	2	1	1	0	0	0	0	2	1	0
Florida	84	78	6	25	1	3	11	49	43	18
Georgia	151	125	26	98	20	27	12	96	55	27
Hawaii	5	4	1	0	0	3	2	3	2	2
Idaho	37	28	9	7	3	42	5	24	21	15
Illinois	241	198	43	85	4	17	15	158	146	70
Indiana	197	148	49	71	17	12	7	139	98	47
Iowa	214	159	55	92	27	30	11	177	140	74
Kansas	248	202	46	142	33	12	28	186	130	95
Kentucky	99	92	7	23	2	2	10	51	60	35
Louisiana	63	59	4	29	0	0	6	45	36	14
Maine	85	68	17	3	0	70	1	57	52	27
Maryland	45	34	11	9	1	8	1	28	30	11
Massachusetts	123	72	51	37	21	29	0	100	72	6
Michigan	197	187	10	91	4	116	7	135	137	66
Minnesota	213	178	35	115	22	34	21	160	130	80
Mississippi	84	84	0	43	0	0	7	45	46	15
Missouri	235	209	26	72	5	6	30	140	130	72
Montana	54	49	5	6	0	26	7	31	27	10
Nebraska	225	192	33	123	22	35	27	154	132	80
Nevada	9	7	2	1	1	9	0	7	7	3
New Hampshire	53	43	10	3	0	40	2	34	32	15
New Jersey	60	49	11	14	2	8	1	46	33	5
New Mexico	27	27	0	4	0	5	3	20	18	15
New York	315	240	75	47	9	139	11	217	156	63
North Carolina	120	90	30	51	19	40	12	76	57	23
North Dakota	108	108	0	16	0	0	27	60	76	62
Ohio	284	225	59	121	23	21	14	179	105	43
Oklahoma	141	137	4	71	1	3	21	105	70	43
Oregon	57	54	3	10	0	49	2	53	37	13
Pennsylvania	243	187	56	41	4	50	11	183	112	38
Philippine Islands	4	4	0	0	0	0	0	3	3	3
Porto Rico	5	4	1	1	1	2	1	2	3	1
Rhode Island	11	5	6	2	2	2	0	10	6	0
South Carolina	75	68	7	31	5	30	10	41	28	19
South Dakota	102	98	4	30	1	5	12	70	74	54
Tennessee	90	80	10	28	2	25	7	52	58	15
Texas	243	226	17	22	4	13	32	181	169	101
Utah	30	26	4	15	1	47	3	22	15	6
Vermont	55	39	16	13	4	55	2	38	30	10
Virginia	82	76	6	19	1	33	4	44	36	21
Washington	86	65	21	13	8	62	6	65	54	34
West Virginia	61	51	10	5	0	8	2	40	32	17
Wisconsin	265	227	38	94	17	129	4	188	163	101
Wyoming	29	28	1	5	0	5	3	18	19	14
U. S. Total	5543	4650	893	1821	304	1411	416	3813	3110	1577
Canada	441	228	153	251	133	183	2	266	229	77
Mexico	51	50	1	2	0	30	0	37	31	4
West Indies	68	65	3	1	0	7	0	12	16	7
Rep. of Panama	2	2	0	0	0	0	0	1	1	1
British Guiana	1	1	0	0	0	0	0	1	1	0
Grand Total	*6106	5056	1050	2075	437	1631	418	4130	3388	1666

NUMBER OF PRIVATE AND MUNICIPAL PLANTS AND DETAILS OF SERVICE FURNISHED

Number having only direct-current circuit, 812; number having only alternating-current circuit, 4651; number having both direct-current and alternating-current circuit, 643.

Of the total of 5543 companies listed, only 1411 use water power. It is also interesting to note that 4650 have generating stations; that is, 893 purchase energy from a local distribution system. The number of municipal systems has dropped from 1851 in 1918 to 1821 for 1919. Of this number 304, or thirty-five more than last year, are purchasing energy from other central-station companies. Day and night service is now being furnished by 3813 companies, 182 more than last year and 69 per cent of the total number of companies. Alternating-current service is maintained by 4651 companies and direct-current service by 812, while there are 643 companies that furnish both alternating-current and direct-current service.

*This figure represents the names of operating companies only. It does not include approximately 1700 generating stations and substations that are listed under the cities these operating companies serve.

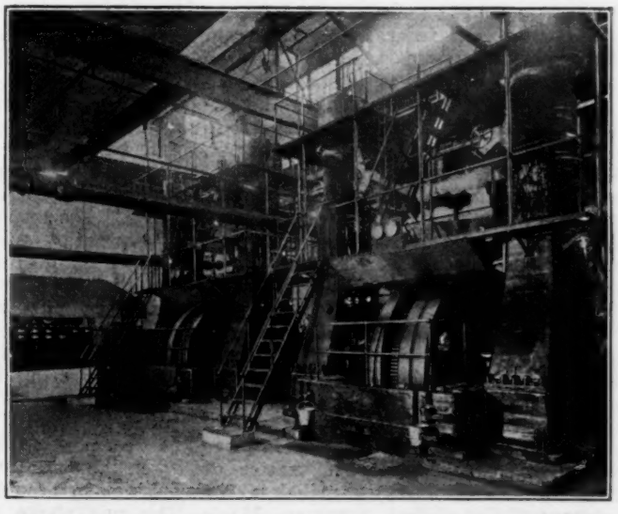
VACUUM-CLEANER THIEF AT WORK IN ILLINOIS

Claiming to Be Without Funds and Just Released from the Army, He Has Sympathetic and Plausible Story

We are in receipt of a letter from G. C. Miller, business manager of the Aurora, Elgin & Chicago Railroad Company, relative to a vacuum-cleaner thief who he fears is engaged in defrauding other electric light companies throughout the country as he did the Aurora company. The letter says:

In behalf of the trade, I wish you would publish in your paper an experience which we had some time ago with a vacuum-cleaner salesman, as I feel that in all probability he is doing in other towns as he did in Aurora. He applied for a position as a vacuum-cleaner salesman. His story was that he had just been released from the army and because of an operation was without funds. Consequently he wanted to get to work immediately. We permitted him to do so and had planned to look up his references the following day. Unfortunately for us, he made away with the samples which were given to him and sold a cleaner which retails at $49.50 for $20.

Concentrating Refrigeration in Large Units



Recent developments in electric refrigeration practice have made that load even more desirable from the central-station standpoint. Desirable load factor it has always had; and now, with the increasing popularity of direct-connected synchronous motors in the ice and refrigeration field, the added advantage of high power factor comes in. As typical of such installations, two 300-ton refrigeration compressors in the Omaha plant of the Cudahy Packing Company are shown in the illustration. These units are each direct connected to a 500-hp., 150-r.p.m., 2300-volt three-phase, 60-cycle synchronous motor taking energy from the lines of the Nebraska Power Company. Thomas J. Byrnes is electrical engineer in charge of the plant.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

"Interstate Commerce" in Electricity.—Discussing the application of "interstate commerce" to the business of the Appalachian Power Company, the energy supply of which is obtained mainly from hydroelectric plants in Virginia, the West Virginia Public Service Commission says in part in a recent decision: "Our highest courts, both state and federal, have recognized that in the complexity of our social and commercial relations there is a twilight zone between the known and defined limits of state and federal authority respectively where public policy and a reasonable regard for the health, comfort, safety, convenience, morals and general welfare and prosperity of the public demand that there must be some regulation of those engaged in the public service, and where the federal authority has failed to act the state authority may, pending such action, step into the breach, even though such state regulation may incidentally and indirectly regulate, restrict or burden interstate commerce. . . . In order to arrive at a proper conclusion in a given case, the only safe guide is to keep constantly in mind the broad and far-reaching but generous objects and purposes sought to be attained by the authors of our federal constitution in incorporating as a part thereof the commerce clause. It was intended to and has promoted and encouraged the exchange and interchange of commodities between the states, free from unjust, unreasonable and unjustly discriminatory burdens and restrictions, but it was never intended that it should have a broader scope or cover a wider field. There has been preserved to the states the right to regulate their local internal domestic affairs, subject only to the limitations that such state regulation shall not in its effect unduly and unreasonably burden, limit or restrict interstate trade. Where the subject matter of the regulation is of purely local concern, although it may in some respects partake of the character of interstate commerce, nevertheless the power of the state is supreme. Manifestly, therefore, unless it can be shown that the fixing of rates by this commission for the electric power furnished the protestants by the applicant in some way unduly, unjustly or unreasonably burdens, limits or restricts the interstate commercial relations of either the applicant or the protestants, or some one else directly affected thereby, the same is not inhibited by or violative of the commerce clause of the federal constitution. As a matter of fact, the well-recognized physical limitations upon the transportation of electricity, plus the fact that Congress has failed to legislate regarding the matter, renders it gravely doubtful whether it is or ever will be a matter of national concern. . . . We think it may be fairly said that the applicant's commerce, so far as its West Virginia consumers are concerned, begins when its electrical energy is transformed into commercial form and started on its way to be delivered, measured, and sold to its consumers."

Changes in Billing Methods.—A decision dismissing a complaint alleging overcharges by the Commonwealth Edison Company, Chicago, in rates for electric welder service has been dismissed by the Illinois Public Utilities Commission. The commission directed the company to file revisions to the existing schedules of rates, eliminating from the schedules the clause at present therein contained relating to the special period to be used in determining the maximum demands of electric welders, hoists, elevators, etc. In part the decision said: "In the cases now under consideration no evidence appears as to the conditions which prevailed at the time of these changes in billing methods. It is certain that these changes resulted in increases of rates to the consumer—just as certainly as though the actual rate of charge per kilowatt-hour had been advanced; but whether some changes in the installation were made at this time, or some previous errors of billing corrected with this increase as a result, does not appear. The respondent, in support of its practices, submitted a book of rules which had been filed with the commission and referred particularly to a rule reading as follows: 'In general a separate service outlet should be provided for all electric welders or furnaces having a capacity of over 20 kw.,' and to a further rule reading as follows: 'Not more than one service will be installed for lighting or for the same class of power on the same premises except at the customer's expense.' The respondent appears to rest its contentions upon the fact that these rules were filed with the commission, and that these rules, which admittedly had been published for many years prior, justified a change in installations at such a time as the company deemed proper to bring them into conformity with the rule. We do not believe that rules filed with the commission can be regarded as a cloak of protection when the actual practices of the utility are not in accordance with that rule. The rule above quoted states that a certain procedure is 'the general practice of the company.' We do not believe that the public utilities commission law contemplates that a statement of general practices filed with the commission shall furnish justification for a change of actual practices which have been in effect for years. Rules and schedules filed with the commission are records, presumed to be correct, of the methods, practices and rates of a utility, but if proved to incorrectly represent such practices, the rules cannot stand as against actual practices and methods employed. The commission, from the evidence which has been brought out in this proceeding, does not think that the Commonwealth Edison Company has any effective rule on file which has justified it, or will in the future justify it, in changing the methods of billing for electric welder service from the methods in effect in 1915. Such a justification, according to the public utilities commission law, can only be secured after a showing before the commission and a finding by the commission that such a change is justified."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Insulation of Line Conductors.—In a recent case the Supreme Court of New York has held that where there is uncontroverted testimony that it is not possible to insulate power wires so as to prevent injuries a judgment based on negligence with respect to insulation could not be sustained, especially where it was not shown that the power company had knowledge, actual or constructive, of the defects causing an injury, or that but for such defects the accident would not have occurred (176 N. Y. S. 281).

Injuries to Bathers.—The Appellate Court of Indiana (123 N. E. 432) has held that a city cannot be charged with constructive notice that a private party has stretched a live wire where bathers in a creek over which the city has control may come in contact therewith, in the absence of evidence as to how long the wire has remained in such position. It is also held that a city having full power and control over a creek in which its citizens are in the habit of bathing is not liable for the death of a bather who came in contact with an electric wire negligently and maliciously placed by a private individual, where the city had no notice of the existence of the wire.

Assumption of Risk.—According to the Supreme Court of New York (176 N. Y. S. 371) a tree trimmer in the employ of the park department of a city, not being the servant of an electric light and power company whose cable, strung a few inches above the limb on which he stood to do his work, broke, because of being partly burned through, cannot be said to have assumed the risk unless he knew the dangerous condition of the limb and stood on it voluntarily. In an action against an electric light and power company for injuries to the tree trimmer his contributory negligence, whether in the nature of shortcoming in precautions or imprudence in actions, was held for the jury.

Missouri River Quite Low.—With a flow of but 2440 sec.-ft. at the Rainbow power house of the Montana Power Company, the Missouri River recently reached the lowest level ever recorded at Great Falls.

Government Sells Platinum.—Confirming the announcement of a month ago that the government would dispose of 19,000 oz. of its platinum supply, the Ordnance Department has already sold 13,000 oz. at $105 an ounce.

To Protect Inventors.—The members of the patents section of the International Research Convention, at its meeting in Brussels, Belgium, reached an agreement on July 25 on the establishment of an international patent bureau for the protection of inventors. Under the new arrangement an American, for instance, will take out a patent in Washington to protect him in the United States, and then would apply to the bureau for protection in every other country, instead of having to apply separately to each of the nations having patent laws.

Stealing Electricity Difficult in Missouri.—Until recently it was very difficult in Missouri to convict persons who placed jumpers around their meters. However, the Legislature has just passed a law which relieves the utility of the responsibility for showing intent to defraud in cases where electricity is being stolen by customers. Since the law was passed surveys of some of the cities have been made showing that a surprisingly large number of patrons were stealing energy. In one city of 80,000 there were 1000 cases in which the meters were shown to have been "jumpered."

End of Fuel Administration.—The Fuel Administration is calling attention to the fact that it has necessarily ceased to function since June 30, for lack of appropriations, by pinning a slip to correspondence and other documents which are leaving its headquarters couched in the following language: "The United States Fuel Administration, being without funds available for expenses after June 30, has necessarily ceased to function. Matters pertaining to accounts can be taken up with the auditor of the State and other departments for direct settlement, and legal matters should be taken up with the Department of Justice."

Pan-American Financial Conference to Meet in January.—The second Pan-American financial conference will meet on Monday, Jan. 12, 1920, according to an announcement made last week on behalf of the government by Dr. S. L. Rowe, Assistant Secretary of the Treasury. The Secretary of State has cabled invitations to the respective governments requesting each to appoint three official delegates. The purpose of the conference will be to discuss the world financial situation, special emphasis being placed on problems arising with the end of the war. The first financial conference was called in May, 1915, by Secretary of the Treasury McAdoo.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Great Western Power Expansion.—The Bankers' Trust Company of New York is to finance the $15,000,000 enlargement of the Great Western Power Company of California, and a mortgage to that amount on the latter corporation was filed in San Francisco July 17.

Great Britain Mulcted in Wireless Suit.—An award of $2,950,000 was given to the Marconi Company, July 28, in a suit for breach of contract brought against the British government. The Marconi company claimed over $35,000,000 for the use during the war of its stations in England, Wales and other points, basing its claim on a provision that the company was to receive royalties amounting to 10 per cent of the gross receipts from the stations for the entire period of the contract, which was to have run for twenty-eight years. The British government claimed that the damages payable amounted to only $250,000.

Italy Urged to Develop Water Powers.—Italy has been urged to develop its water-power resources to their capacity by Signor Maffeo Pantaleon, engineer and dean of Italian economists. He declared recently that his country could save three-fourths of its coal consumption by making use of its hydroelectric energy. During the war period the shortage of coal forced Italy to depend more and more upon electric power, and since 1914 several of the Italian cities, notably Milan and Turin, have spent great sums on hydroelectric developments. At present the annual consumption of coal amounts to 12,000,000 tons, for all of which Italy is dependent upon either England or the United States.

Data on Foreign Reconstruction Activities.—The following statement is issued by Grosvenor B. Clarkson, director of the United States Council of National Defense: "Realizing that American business must, with the signing of peace, be furnished with information concerning foreign reconstruction and readjustment activities, the United States Council of National Defense has prepared for distribution the latest data available. Because of the practical impossibility of supplying all business interests throughout the country with separate copies of this digest, it has been considered best to furnish the public libraries of the country with two copies each, and in addition to deliver a copy to each of the member organizations of the United States Chamber of Commerce, as well as to all trade journals."

Siemens-Schuckert Employees Strike.—All of the employees of the Siemens-Schuckert Company, one of the largest electrical concerns of Germany, struck on the afternoon of July 25. The number of workers affected is 30,000. The men went out because of the discharge of 10,000 of their fellow workers at two other plants of the company.

American Public Utilities Company Discontinues Dividends.—President Joseph H. Brewer of the American Public Utilities Company has written to preferred shareholders in regard to the discontinuance of dividends. He refers to the mistaken expectation that labor and material would resume their normal prices when the war was over. Mr. Brewer adds: "It is apparent that, in common with many others, we have been mistaken in this assumption and that the present high prices of labor and materials are here to stay, at least for some time. Not only must the temporary emergency rates heretofore granted be extended, but permanent higher rates must be secured by our subsidiary companies to meet the existing costs of operation, and until such increases are granted and the income of the several companies thus placed on a stable basis your directors deem it prudent to discontinue the payment of dividends. The directors are very hopeful (now that the new conditions are actually apparent) that higher permanent rates may be speedily secured."

Electrical Equipment in Powder Plant.—Illuminating facts about the enormous government work occasioned by the war are beginning to come to light as inventories are made of the completed or partially completed jobs. For instance, an inventory of the United States government's explosives plant "C" at Nitro, W. Va., shows that there was installed 1,551,857 ft. of electrical conductor, ranging in wire sizes from No. 8 B. & S. gage to 350,000-circ. mil. and including some 1-in. by $\frac{3}{16}$-in. strap copper. The total conduit installed amounted to 390,597 ft. These figures are for both light and power installments. The conduit ranged in size from $\frac{1}{2}$-in. to 3-in. and included 35,411 ft. of flexible conduit. Condulet bodies, condulet, V. V. fittings, Adapti boxes, R. & S. fittings, knockout and pull boxes totaled 27,634. Of steel service boxes there were 2422. Other wiring devices included 49,293 tubes, 30,850 cleats, 120,356 knobs, 11,650 bushings, 13,742 rosettes, 5,446 porcelain receptacles, 1391 composition receptacles, 15,173 brass sockets, 341 weatherproof sockets, 625 porcelain sockets, 188 clusters, 13,281 reflectors, 9474 vaporproof fixtures, 770 knife switches, 2321 service switches, 1945 flush switches, 4042 panel switches and 1020 snap switches. The motor inventory for the various plant areas showed a total of 1023 motors, with an aggregate rating of 27,048.25 hp. The most widely used motor was the 7.5-hp. size, of which there were 276. The 10-hp. size was next, with a total of 124 motors. The smallest motors were rated at 0.25 hp. and the largest at 300 hp.

H. F. Cameron, formerly connected with the Lake Charles Railway, Light & Waterworks Company, Lake Charles, La., has been appointed vice-president and general manager of the Texas Gas & Electric Company at Houston, Tex. His appointment became effective Aug. 1.

J. S. M. Wharton, president-elect of the Arkansas Utilities Association, is secretary-treasurer and manager of the Helena (Ark.) Gas & Electric Company. Mr. Wharton was graduated from Lehigh University in 1909 and for about three years thereafter was employed in the various departments of the United Gas Improvement Company of Philadelphia. He then became manager of the People's Light, Heat & Power Company of Barre, Vt. Later he resigned that position to become manager of a syndicate of gas properties in North and South Carolina, where he stayed until he went to Helena, Ark., about two years ago.

J. S. M. WHARTON

Roy Page has been promoted to the position of general superintendent of the Nebraska Power Company. He will have general supervision of the power station, purchasing department, garage, storeroom and the claims and welfare department.

Charles J. Cookson, formerly superintendent of the Montpelier & Barre Light & Power Company, Montpelier, Vt., has succeeded H. D. Larrabee as manager. Mr. Larrabee has recently resigned to become general manager of the Eastern Connecticut Power Company, as announced in last week's issue.

R. Sanford Riley, president of the Sanford Riley Stoker Company and the Murphy Iron Works, sailed for Europe on July 26 aboard the Aquitania. Before his departure Mr. Riley was appointed honorary vice-president of the American Society of Mechanical Engineers. He will represent the society and this country at the James Watt Centennial, which is to be held at Birmingham, England, on Aug. 25. Mr. Riley expects to return about Oct. 1.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

A. W. Houston has resigned as vice-president and general manager of the Texas Gas & Electric Company at Houston, Tex., to accept a similar position with the Southern Utilities Company at Palatka, Fla. Mr. Houston will have supervision of the plants of the Southern Utilities Company, in Florida and Georgia.

H. M. Turner has been made assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. Professor Turner graduated from the University of Illinois, and for several years he was in the electrical engineering department of the University of Minnesota. He went to Yale last fall as assistant professor of radio and advanced electrophysics and directed the field radio work of the Signal Corps training school for officer candidates. After its disbanding he became associated with the electrical engineering department, in which department he is now continued.

William D. Ray, who for the past year has been supervising utilities officer of some twelve military camps in the Southeast, has been relieved of his duties and will soon return to the public utility field. Mr. Ray has not as yet announced a definite connection. For many years he has been a prominent figure in the central-station field, lately as vice-president and general manager of the Pennsylvania Utilities Company at Easton, Pa., and for several years prior to that as vice-president and general manager of the Northern Indiana Gas & Electric Company, a property of the United Gas Improvement Company.

Dr. V. Bush, who has been appointed associate professor of electrical engineering at the Massachusetts Institute of Technology, is a graduate of the electrical engineering course of Tufts College and received an M.S. degree from that college in 1914. In 1916 he received the degree of doctor of engineering from the Massachusetts Institute of Technology. During the course of scientific researches in the war Dr. Bush was associated with the New London researches of the United States Navy for the detection of submarines. In his new position Dr. Bush will take up a portion of the instruction to undergraduate students heretofore given by Professor Wickenden, who recently resigned to go permanently into the service of the Western Electric Company. In addition, Dr. Bush will give a course of advanced lectures to post-graduate students and dedicate the rest of his time to research.

O. H. Simonds, the president-elect of the Iowa Section, National Electric Light Association, was born in Duluth, Minn. He was graduated with the degree of mechanical engineer from Cornell University in 1908. For seven years thereafter he was employed in various capacities with the General Electric Company, spending the last four years of that period in the lighting and railway department of the General Electric Company's Chicago office. He then resigned to enter the engineering department of Messrs. Elston, Clifford & Company of Chicago, and later became general manager of the Vicksburg (Miss.) Light & Traction Company. While he was in that state he served two years as president of the Mississippi Section, National Electric Light Association. In September, 1917, he was appointed general manager of the Dubuque (Ia.) Electric Company, which position he still occupies. Mr. Simonds, in addition to being active in state association work, has also taken part in committee work of the National Electric Light Association, giving particular attention to the committee on geographic sections.

O. H. SIMONDS

Obituary

George Ward Cook, who recently died at Haverhill, Mass., installed the first electric lighting generator used in a commercial establishment at that place. He was also active in forest conservation work in New Hampshire and an expert accountant. He resided at Haverhill the greater part of his life.

Laverne W. Noyes, president of the Aeromotor Company, Chicago, died July 24 of broncho-pneumonia. Mr. Noyes was well known as an inventor of windmills, having been interested in their construction since 1887. He also developed early designs of steel towers for transmission lines. Mr. Noyes was born in Genoa, N. Y., in 1849 and was graduated from the Iowa State College in 1872.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

DEMAND FOR HEAVY-DUTY ELECTRIC COOKING EQUIPMENT

Pacific Coast Business Very Large, Most of It Coming from California Institutions and Pleasure Resorts

There has never been a call on the Pacific Coast such as there is now for hotel ranges, large bake ovens and other similar heavy-duty devices. Most of this demand emanates from resort keepers who, after experiencing the best summer season in their history, are looking about for new features for 1920. The Camp Curry installation in the Yosemite Valley, which daily cares for 1500 people, also has proved a big boosting factor. Window baking, now so popular, has demanded a number of electric bake ovens. Besides, a great many inquiries come from new hospitals with which various counties in California are equipping themselves, principally for the care of tuberculous patients, who require very clean and sanitary arrangements.

ADVANCE IN THE PRICE OF RANGES STIRS WEST

Dealers Seem to Expect Drop in Sales—Eastern View of the Subject Is Different—Larger Heaters than Those Supplied Are Wanted

A recent advance in price of 25 per cent on electric ranges has brought comment from the Western coast. In the San Francisco territory the chief topic of interest to central-station men and dealers at present, it is reported, is the subject of ranges. The sentiment seems to be that the sales and public interest will fall off because of what is considered as a startling and unexpected advance in price. Although it is felt that this interest will have to be recreated later, still projected campaigns will be carried through.

One of the power companies quotes list prices less 10 per cent for cash, or list for time payment on the range only. Another power company quotes an installed price, adding $50 list for the purpose and a further 10 per cent for carrying the account to the extent of a year. Local stocks are poor, and sixty days is a moderate estimate for the average factory handling of a stock order.

In the majority of range sales a water heater accompanies the installation, the tendency being to specify thermostatic control. Another tendency is to specify heaters of a higher wattage than previously. Where 2 kw. was heretofore considered ample for the average 30-gal. boiler, 4 kw. and 5 kw. are now demanded, it is reported.

Further up the Western coast it seems that sales are not being pushed. Buying for home use is reported on the decrease, with most of the sales going to apartments. Here stocks are well balanced.

In the East one manufacturer has stated that it is not expected that price will have any effect on purchasing. If the customer has any use at all for the range, he will pay the price asked, regardless of the increase.

On the other hand, manufacturers have justified their advances through revision of cost accounting on their ranges. Heretofore some have been sold at an actual loss. A close survey of manufacturing costs, especially labor, has shown the necessity of this advance in price in order to show a legitimate profit.

ELECTRICAL JOBBERS PREDICT GOOD BUSINESS SEASON AHEAD

Review of Sales, Stocks, Collections and Cost of Doing Business for the First Half of 1919 Is of a Favorable Nature

The business outlook for the remainder of the year in the electrical trade is particularly bright. Stocks are for the most part normal or above normal. Several are below normal because of a shortage in some lines; but, owing to the expectation of an advance in prices, the majority are stocking heavily. Generally speaking, sales have increased remarkably well, considering that the war orders have fallen off to almost nothing and that the increase represents commercial business. The cost of doing business also has increased slightly, although approximately 20 per cent of the jobbers report that the cost of doing business is the same or less. Collections are very satisfactory.

From present indications only about 20 per cent of the trade have stocks below normal, while more than 40 per cent report a full stock. Manufacturers do not seem to be able to supply the demand for household labor-saving devices and appliances, and the demand for building and wiring materials appears to be steadily increasing. Many jobbers are endeavoring to build up their stocks above the proper level, but cannot do so because of the difficulties in securing certain lines from the several sources of supply. Others who are more fortunate have anticipated a shortage this fall and have protected themselves by overstocking previous to this time. Deliveries by manufacturers in appliances and copper products are slowing up considerably. Others have built up stocks above normal in view of anticipated increase in business and poor railroad service.

Outlook in Different Territories

Electrical jobbers in New England territory believe that the business outlook for the remainder of the year is very good, and some have expressed themselves as having every confidence that it will be the largest ever known. The tone in the Middle Atlantic section is about the same. Some are of the opinion that when building starts up on a larger scale, which it surely must do in the near future, the difficulty will be in supplying the demands. From another Eastern section a largely increased business in appliances and holiday material is looked for as the outstanding feature; next in order of importance and in extent will be the activity of industrials, and activity on the part of central stations and of electrical contractors as they may be affected by building started this year. One general contracting concern within the last month has closed contracts amounting to more than $2,000,000. Reports from Southern territory indicate that unless labor troubles interfere the best year in the history of the business is looked for. Optimism prevails generally in the central districts concerning conditions, with the one possible exception of labor troubles. In the north central districts building operations are large and architects and builders are unable to keep up with the demands made upon them for new structures. In this district the feeling is general that it will be more of an effort to secure sufficient material to take care of the business than it will be to secure the business.

Business for the first six months of 1919 compares most favorably with the same period of 1918, as regards both volume and gross profits. This is most encouraging, since the nature of the business for 1919 is decidedly different

from that for 1918, when most of the business constituted war orders. Several outlying districts report a considerable decrease in sales, but these are no doubt due to the large war orders of the previous period. Reports from the Far West indicate that sales this year are more than those of the corresponding period of 1918, although last year's sales included a great amount of shipbuilding work. This has been offset in part by activities in other directions where war conditions had retarded developments.

COST OF DOING BUSINESS INCREASES SLIGHTLY

The cost of doing business has increased slightly in New England territory. It is claimed that material is being sold there at less profit, due to competitive conditions, than has been the case for quite a number of years. However, as conditions are gradually becoming better, it is hoped that this condition will rectify itself. Several districts from the Central West report that, although the cost of doing business has increased, individual orders are larger and that the volume is so much larger that the ratio of overhead to gross profits is about normal. Another district reports that the months of February, March and April were distinctly disappointing, but that business since then has been steadily increasing and that on the present basis the 1918 business will be exceeded. Another central district reports that all expenses are much higher than they were a year ago and that the volume of business must be retained and increased if adequate profits are to continue. In some cases the volume of gross profits compares favorably with 1918, yet there is a decided increase in expenses due to necessary adjustments in salaries, and it is expected that this overhead will continue to increase during 1919. The cost of doing business is noticeably heavy in the South, where reports state that it is increasing out of all proportion to the increased volume and is the subject of greatest consideration.

Collections in New England districts are in good shape. As yet there is slow resumption of building, but with increasing activity in that line an unusually large business is looked for. In the central districts collections are good, and by the extensive use of trade acceptances the average collections have improved very materially. It is evident, however, that the relations between profits and overhead expenses must be closely watched if the same net returns are to be shown as were shown for 1918. In some sections customers are buying in larger quantities and not demanding as long time credits as formerly. In the central districts conditions are very favorable except that some jobbers have found it necessary to accept sixty-day and ninety-day paper from some of the holding companies this year, although these obligations usually are promptly taken up when due. Deferred payments on washing machines and other appliances are coming in promptly. In the farming districts collections were good up to July 1, but have slowed up during the past month, as the farmers have been working in the fields and not getting into town. This has resulted in the country merchants being slightly delayed in making their usual remittances. Credits should be watched closely, as there is still a tendency to overbuy, fearing an advance in prices. Moreover, labor unrest may upset deliveries and the completion of contracts, thus making contractors unable to pay promptly. Collections in the West are good. In some places they are somewhat slow but not slow enough to cause alarm.

INDUSTRIAL TRUCK SALES ARE PICKING UP RAPIDLY

Higher Prices for These Vehicles Are Expected Before Long, with Excellent Outlook for Future Demands

Within the last month—in fact, since peace was signed—the market for electric industrial trucks and tractors has seemed suddenly to have come to life again. During the first half of the year the volume of new business booked was very discouraging. The readjustment period following the signing of the armistice naturally brought industrial uncertainty, and consequently fewer orders were placed. In fact, in many plants general orders were issued absolutely forbidding the purchase of any new equipment.

Now orders are coming in more rapidly than at any time since the armistice was signed. At least one prominent manufacturing concern has "passed, almost at a jump, from a condition where accumulating stock was becoming dangerous to one where sixty and ninety days' delivery will very shortly be our best quotation."

There does not appear to be any indication of lower prices of trucks and tractors this year. Two of the larger concerns state that the combined high cost of labor and materials will necessitate a general increase in prices. One authority expects an advance before the summer is over. In this connection it is interesting to note that an Eastern concern is putting a new truck on the market which is to sell for from $200 to $300 below the current market level.

Deliveries generally are good, but as pointed out above it may not be long before they again get behind.

The outlook is considered to be better than ever. A greater realization of the scarcity of labor, with the increasing high prices thereof, is stimulating the demand for

TABLE SHOWING CONDITION OF THE ELECTRICAL JOBBING FIELD FOR FIRST HALF 1919

Location	General Outlook for Last Half of 1919	Stocks Above or Below Normal	Comparison of First Half of 1919 with First Half of 1918		Condition of Collections
			As to Sales	As to Cost of Doing Business	
New England: Four jobbers	One good Two very good One excellent	Two normal One above One below	One same One 15% larger Two larger	One 4% higher One 1% higher Two same	Two fair One good One excellent
Mid-Atlantic: Fifteen jobbers	Eight good One fair Three very good Three excellent	Four normal Six above One 10% below One 20% below Three below in some lines	Four average of 22% larger Four average of 11% smaller Four larger Three smaller	Five average of 22% higher Two 3% higher Three 1% higher One same Four higher	Six fair Six good Three excellent . . . . .
Central: Nineteen jobbers	Ten good One poor Four very good Four excellent	Nine normal Eight above Two below	Seven average 30% larger Four larger Four 10% larger One 4% smaller Two same One 50% smaller	Two less One same Six higher Eight average of 2½% higher Two 35% higher	Four fair Eleven good Four very good . . . . .
Southern: Four jobbers	One fair One good Two very good	One normal One below Two above	One larger Three average of 20% higher	One 1½% higher Two 2½% higher One higher	One fair One good One very good One excellent
West: Seven jobbers	One fair One poor Three good One very good One excellent	Five normal One below One above	One same One smaller One larger Four average of 18% larger.	One same One higher Two up 7½% One off ⅞ of 1% Two up less than 1%	One poor Two fair Four good . . . . .

these equipments. Nor does the war tax on top of war prices seem to deter large corporations from placing orders now that they have decided that here is a permanent condition, or at least one which will continue for the current year. Proposals which have been on file for months have been accepted and rush deliveries are asked for by the purchasers.

One of the larger concerns expects to regain by Jan. 1 the point on its normal increase curve, not taking into consideration the peak reached last year.

METAL MARKET SITUATION

Buying Has Dropped Off Considerably—Copper Is Slightly Lower than Recent Quotations

Extreme quiet has characterized the metal market the past few days. Copper, which has held the center of the stage so completely of late, has not only stopped in its upward climb but has been marked off 1⅛ cents from a week ago. The larger producers were holding their prices well at that time, but now have begun to shade. The speculators still are the best hands at the shading game, however. Electrolytic is being quoted at 22 cents a pound. It seems that the larger producers are willing to have the seconds shade the price to get the orders, because they feel that they themselves will come in on the volume of ordering which they feel will set in again in a short period of time.

The amount of copper being purchased now for domestic consumption is small. Export buying is reported for France, England, Japan and Scandinavia, and purchases have even been recorded for German account.

In the last quarter of the year it is expected that much buying for European account will be inevidence. Domestic consumption is satisfied for the present, it is stated, so that the fall months should prove active for buying for home consumption. Little copper is now being bought for the last quarter.

Standard copper in London has fallen off over £8 in the last week, while difference in exchange has varied little.

Zinc, which showed some activity a week ago, has become quiet again, and its price has declined a small fraction of a cent.

The railroad strike in the Chicago territory has caused suspension of work of many thousand men, the banking of several furnaces and the shutdown of a number of steel mills.

In the scrap market heavy copper and brass prices have declined ⅛ cent and buying has fallen off considerably. Now dealers are more anxious to sell than purchasers to buy.

NEW YORK METAL MARKET PRICES

	July 30	Aug. 6
Copper:	£ s d	£ s d
London, standard spot	104 10 0	96 0 0
	Cents per Pound	Cents per Pound
Prime Lake	23.50	22.50 to 23.00
Electrolytic	22.75 to 23.50	22.00
Casting	22.25 to 22.50	21.62½
Wire base	26.00	26.00
Lead, trust price	6.00	6.00
Antimony	9.25	9.12½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.50	10.50
Spelter, spot	7.90	7.72½
Tin	70.00 to 71.00	70.00
Aluminum, 98 to 99 per cent	32.00 to 33.00	30.50 to 32.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	20.50 to 21.00	20.00 to 20.50
Brass, heavy	11.00 to 11.50	10.50 to 11.00
Brass, light	9.50 to 9.75	9.50 to 9.75
Lead, heavy	5.50 to 5.62½	5.12½ to 5.50
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

WELL-SCATTERED reports show jobbers' sales throughout the country in satisfactory shape. Building is progressing in good volume, as a rule, although still well below normal. Labor troubles in building trades are having a slight effect on the industry, but it is expected that economic factors will more than balance this difficulty.

The possibility of a nation-wide strike of railway employees looms up as the most important development this week. Many thousand shopmen in the Chicago district are already out, and some industrial operations have begun to suffer in consequence.

Deliveries are being reported slower and slower, especially in the Central, Southern and Western territories. For this reason jobbers are attempting to lay in bigger stocks than they normally would consider. These stocks cannot in all cases be supplied by manufacturers.

Few price changes have been reported outside the wire market. Local conditions have been responsible for some slight advances.

NEW YORK

The supply business is in good shape and continues to pick up in many instances, according to jobbers' reports. Fan sales have fallen off with the advance of summer and the small number of extremely hot days, but there have been better sales of wiring devices and rigid conduit and its supplies. Rubber-covered wire and weatherproof wire not only in small but also in large sizes are moving in better volume.

Labor conditions as a whole show up in a serious way this week. Although troubles in some spots have been ironed out, new ones are developing in other localities. Traction men in Brooklyn have gone out on strike, and in New York City building construction is being retarded because of strikes and lockouts for sympathetic strikes. Responsible contractors are not inclined to figure on prospective work freely, so long as there is no certainty as to how long wage scales will remain at a given level.

WIRE.—Producers of rubber-covered wire have advanced their bases as much as 2 cents in some cases. Six have been reported on 28 cents, one on 29 cents and seven on 30 cents. Bare base is holding at 26 to 27 cents, while weatherproof holds well at 26 to 29 cents base. Weatherproof wire in the larger sizes is having a better sale. Silk-covered cord and slow-burning wire sales are shown in increasing volume.

RIGID CONDUIT.—The price increase of two weeks ago has had the effect of boosting sales from manufacturers' stocks.

RANGES.—Sale of electric ranges in the New York territory is not only continuing in good volume but is constantly showing better results. In some cases deliveries are behind orders. In the latter part of July prices increased 25 per cent.

FANS.—The market for fans has dropped off to a considerable extent, but there still seems to be considerable business done in ceiling fans and nickel-finished oscillating fans for restaurant work. Small-size exhaust fans are not reported moving in any particular volume, but sales of the larger sizes of ventilating systems are in good shape.

LINE HARDWARE.—Hardware prices are still holding, although it is expected by manufacturers that there will soon be an increase. One company in the middle of last month raised its prices on brackets for lighting work 5 per cent. Jobbers are ordering more frequently, but still in rather small quantities on each order.

TABLEWARE.—There seems to be less call for toasters, percolators, etc., during the summer season that one would normally expect. Although prices advanced from 5 to 10 per cent early in July, at least one company will not take orders now except at the price which shall prevail at date of shipment.

WIRING DEVICES.—Reports seem to indicate that business is spotty, with good orders from certain localities of the district and only a fair movement of material in other sections. Some buyers are ordering in rather large volume, apparently with the realization that prices are tending upward rather than downward on the material which they feel sure they will need very soon.

CHICAGO

The street-car strike and the rioting in Chicago last week hurt business, but in spite of these adverse conditions July was a good month for the jobbers. Some of them exceeded last year's business, which was exceptionally good. Deliveries on practically all materials are bad, freight service is slow, and in most cases jobbers are having greater difficulty in getting materials than they experienced before the armistice was signed. The street-car strike was settled last week, but about 75,000 railroad shop men walked out, making about 200,000 Chicago men locked out or on strike. Building operations are still at a standstill in Chicago, but other cities are going ahead with construction. In St. Louis the First National Bank will commence the erection of its building immediately, and arrangements have been completed for financing the construction of bungalows and apartments at an estimated cost of $942,000. A combination theater, store and apartment building is to be built in Omaha, in addition to a garment factory and a truck body plant. A new company organized for the manufacture of car wheels is to build its factory at Hammond, Ind.

COPPER WIRE.—The price was steady last week. Rubber-covered was on a base of from 28 to 30 cents, weatherproof 28 to 29 cents and bare wire around 28 cents. Distributers' stocks are incomplete and there is little No. 14 weatherproof or rubber-covered wire available.

RIGID CONDUIT.—Buying is being stimulated by the advance in price about two weeks ago and by the possibility of further price increases at any time.

SCHEDULE MATERIAL.—The demand is growing. Prices have been stationary, but one manufacturer has notified his distributers that all orders are subject to the price at the time of delivery.

FANS.—An increasing number of jobbers have sold out for the season, though some still have well-assorted stocks. Dealers are depending upon hot weather in August to move their stocks.

PORTABLE WOODEN LAMPS.—Dealers are placing orders with manufacturers for their fall and Christmas supplies. No delivery promises are being given and the lamps will be billed at the prevailing price at the time of delivery.

METAL PORTABLE LAMPS.—Deliveries are fair and one manufacturer increased his price recently about 20 per cent. Other increases are expected by dealers.

HOLLOW WARE.—The price was increased between 5 and 10 per cent by one manufacturer about ten days ago. Deliveries are generally poor.

FOOD WARMERS.—A reduction in price of from 3 to 5 per cent was announced recently by one manufacturer of hot closets designed to be built into the wall.

ELEVATORS.—The demand for both freight and passenger elevators is unprecedented and a price advance is expected.

RANGES.—Another manufacturer has been added to the two who increased their prices from 20 to 25 per cent two weeks ago. All manufacturers have not increased their prices yet.

CREDIT AND COLLECTIONS.—Industrials as a class are considered good pay at the present time, but company routine causes many to be listed as slow pay. This condition has improved since the armistice, but bills are not yet approved for payment as rapidly as in pre-war times.

BOSTON

Business is very active. Jobbers' stocks are fairly large, barring a few short lines in which metallic flexible conduit is a conspicuous example. Appliances and larger devices for domestic service are selling well. Collections in July were not quite so good as in the preceding three months, but nothing disturbing is evident in this department. Building trade expansion continues and orders are now coming in to the distributers as a result of construction work having got well under way. Prices are a little tighter, wire and iron conduit moving upward slightly from former levels. Deliveries are not as yet causing much anxiety, though long-distance buying is in evidence.

The labor situtation is the chief element of disquiet, and the fear that the unions may saw off the limbs on which they are sitting is widespread. Electrical labor conditions are for the time being fairly quiet, barring the traction strike at Providence, R. I., now in its third week. Retailers of electrical supplies are doing a fine business. Electrical contractors are doing a "spotty" business. Gradually, however, there appears to be a recession taking place from the war-time inactivity, from which not a few contractors suffered. Residential work is in much demand, and large amounts of money are being expended on betterment activities, despite high prices.

WIRE.—Rubber-covered wire is quoted on 29-cent and 30-cent bases this week. The chief demand is for smaller sizes of wire, new building work absorbing stocks rapidly. The factories are extremely busy. Bare copper wire at 26½ cents and weatherproof at 27 cents were quoted Monday.

WASHERS.—A record-breaking business is being handled. Machines arrive only to go into almost immediate service. The Brokaw-Eden factory at Lowell, Mass., began shipments last week, and it is expected that by Sept. 1 or before orders will be filled the day of receipt. A representative of the "Gain-a-Day" organization announces that a three-hundred-thousand-dollar factory addition is putting production facilities on a new plane for distributers. Washing-machine prices are firm.

VACUUM CLEANERS.—Sales are well maintained. A Massachusetts factory is now turning out over 300 machines a day and will soon reach the 400 rate. Prices hold firm, and retail interest is very active despite the vacation season.

MOTORS.—Orders are coming in well for small and medium-sized outfits. The demand is not cutting seriously into jobbers' stocks as yet, although these would soon be heavily reduced if factory production were not well sustained.

FANS.—Cooler weather has put a quietus on current fan sales. Some jobbers' stocks are considerably reduced, but unless an extraordinary term of hot weather supervenes New England will get through the summer very comfortably on the existing stocks in retailers' and wholesalers' hands.

APPLIANCES.—Every week the public absorbs appliances at a gratifying rate. Flatiron sales are responding to a very stable demand. Curling irons, hot plates and grills are also moving freely.

CONDUIT.—A three-point advance in price took place last week. Reports of an insufficient supply of pipe in this district are beginning to pass around.

FIXTURES.—Prices are in a state of upheaval. The factories are withdrawing previous quotations and discounts, and further advances are looked for. The "old reliable" houses still have good stocks, but deliveries are tending to increase in length. Floor and portable lamps are a bit dull for the moment.

ATLANTA

The features of interest this week are the steady climb of copper prices and the heavy buying of jobbers covering all standard material for quick turnover. Although the volume of business transacted by the manufacturers is less than last year, the number of individual orders has rapidly increased. Jobbers and dealers have probably purchased more goods in the last sixty days than they did in the first

four months of this year. There is a feeling that with an ever-growing demand and the movement of crops, transportation facilities will be crowded and shipments will be hard to get through, and as a consequence substantial orders are being put through to combat this difficulty.

IRONS.—Retail sales are active, but jobbers report a comparatively dull period. Stocks are well filled.

SAFETY SWITCHES.—New apartment and residence construction has tended further to accelerate this item. Jobbers report an excellent business. Local stocks are ample and incoming shipments from factories are prompt. The recent 20 per cent price advance has not curtailed buying.

FUSES.—The demand continues steady. Southeastern stocks are well distributed. No change in price has been noted for some time.

KNIFE SWITCHES.—The call remains insistent. Local stocks are in good condition, however.

CONDULETS.—These are moving very fast, stimulated by the growing industrial work opening up. On the whole, Southeastern stocks are low, with the exception of those at a few scattered points. Factory shipments are slowing up.

LAMPS.—Jobbers and dealers have accumulated stocks sufficient to handle the coming fall demand. Manufacturers' stocks, too, are in excellent shape, and it is not expected that any shortage will exist as the government demand has leveled out compared with the same period last year. Sales to date are well ahead of last year.

FANS.—All fan stocks are being cleaned out as a result of the hot wave this week. Scattered incoming shipments for jobbers that anticipated the present condition are filling in the gap in certain instances, but it is evident now that early orders for fans were placed too conservatively and a nice business has been lost.

TRANSFORMERS.—Southeastern stocks are well distributed and up to normal on standard 2300-volt distributing type. The volume of sales is steadily increasing and manufacturers are expecting an even greater business as the year advances. Power-type requirements are growing, coincident with industrial activity and extensions. Central stations are getting in better shape to take on new business.

WIRE.—Weatherproof advanced to a 29-cent base and rubber-covered to 26 cents. Manufacturers report a heavy demand for all sizes, and this condition is reflected through distributers and dealers. No. 4/0, No. 8 and No. 6 weatherproof are scarce and stocks of Underwriters' slow-burning No. 8 are low. Shipments from a few manufacturers are good in the face of labor troubles.

STREET-LIGHTING EQUIPMENT.—Business is quite active from the larger municipalities utilizing 400-watt and 600-watt units. Stocks are low, but factory shipments are fair. The market for constant-current transformers is livening up and a number of deals are pending. Good deliveries are being made from factory stocks, and prices have weakened slightly.

SEATTLE—PORTLAND

The jobbing market presents nothing of interest this week in Seattle beyond maintenance of a pretty fair buying movement, especially along the lines of domestic appliances and housewiring devices. The volume of supplies to shipyards and industrial plants showed no change because the situation as regards new contracts for steel ships or renewal of canceled contracts remain practically the same. While negotiations with foreign interests for ships to be built in Puget Sound are on, no contracts have been definitely awarded, so far as can be learned. Of the 125 big steel ships yet to be awarded by the United States Shipping Board, it is expected that the yards on the Pacific Coast will get a considerable percentage.

The Seattle yards confidently expect to land their share of this business. Bumper crops are reported from all over the state. The Inland Empire in eastern Washington particularly reports unexcelled crop conditions. The number of building permits, especially for residence construction, in Seattle continues to grow each week. Other large cities in the Puget Sound district report like conditions. As a consequence of building operations, wiring contractors and small dealers are doing an excellent business.

Portland territory continues to report an unusual activity in household appliances, especially of washing machines, vacuum cleaners, ranges and electric tableware. Building continues strong. Sales to shipyards and allied industrials are rather light, although no decrease of any moment is shown over the past three weeks.

MOTORS.—The demand for small alternating-current motors shows a slight increase, while the demand for larger sizes is light.

WIRING DEVICES.—Jobbers in Seattle report some difficulty in maintaining stocks of house-wiring devices on account of the unusual demand in this territory. Increasing building activity in rural districts around Seattle is making further drains on local dealers' stocks. Recently shipments from the East have been coming through sporadically, and at present stocks are not all that could be desired.

FANS.—Report from Spokane states that the recent hot weather increased sales of fans remarkably. Retailers, anticipating early demands weeks in advance, placed orders and were in good shape to handle the volume. Unofficial reports state that jobbers' stocks just handled the demand and that was all. Eastern Washington this year has experienced an unusual amount of warm weather, and dealers from all over that section report excellent fan sales. In the Puget Sound district sales are below normal, as the summer season has been exceedingly cool and pleasant.

SAN FRANCISCO

Actual orders have slackened, but inquiries promise a big fall business in all lines, even including that of line-construction material, which has hitherto been dormant. Labor conditions are quieter and more promising. The telephone strike has been settled, and there is no immediate prospect of a strike of electrical workers or the shipyard strike which was predicted for the latter part of July. On the other hand, the reported strike of railroads all over the country will hit the Pacific Coast exceedingly hard, owing to its distance from the big factories in the East. Railroad deliveries have been appreciably slower during the past month for a carload shipment and about six weeks for less than carload shipments from the Atlantic seaboard.

Building permits for July, for the three principal California cities are: Los Angeles, $1,900,000; San Francisco, $1,800,000; Oakland, $600,000. Credits are fair, with an increased tendency to extend the term of payment by means of trade acceptance, ninety days being the usual period. Collections are excellent.

HIGH-TENSION INSULATORS.—Several exceedingly large jobs have recently been awarded, one in Fresno on the line of the San Joaquin Light & Power Corporation, and the Southern California Edison job. Manufacturers are busily figuring on a sixty-five-thousand-dollar insulator job for the Great Western Power Company which so far has been unawarded. These jobs indicate the power extension activities of the State.

POLE-LINE HARDWARE.—There has been a dearth of small jobs, and most of the big jobs above reported will take steel towers. This will reduce standard pole-line hardware to a minimum.

CROSS-ARMS.—The cross-arm market has been quiet. Local stocks are good. Prices have advanced about 10 per cent, due principally to labor conditions in the Northwest.

WEATHERPROOF WIRE.—Weatherproof wire is still climbing, with base sizes now selling in carload lots at 31 cents per pound f.o.b. Pacific Coast points.

RUBBER-COVERED WIRE.—Rubber-covered wire sales are favorably estimated as being about 25 per cent above the output at this time last year, and in fact it is difficult to accumulate the reserve stocks which all feel will be demanded before the year is over.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$90.00 to $100.00
Coil to 1000 ft	85.00 to 82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to List
1/5 to std. pkg	List to 20%
Std. pkg	23% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.40	.40
50 to barrel	.36	.37
Barrel lots	.329	.339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1 1/4	50	21.00
1 1/2	50	26.00
2	25–50	35.00
2 1/2	25–50	45.00
3	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
1/2-in. single trip	$75.00	$63.75— 69.75
1/2-in. double strip	75.00— 82.50	72.00— 75.00
3/4-in. single strip	100.00	85.00— 93.00
3/4-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
1/2-in. single strip	$75.00	$63.25 to $63.75
1/2-in. double strip	78.25	71.25
3/4-in. single strip	100.00	75.00 to 85.00
3/4-in. double strip	105.00 to 109.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05 1/2	1	$0.25
1/2	.06	1 1/4	.33
5/8	.09	1 1/2	.40
3/4	.12	1 3/4	.47
7/8	.15	2	.55
1	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$30.00	$22.00	$21.00
1/2-in.—	35.00	24.00	23.00

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
3/8-in.—	$33.00–$42.00	$17.50–21.00	$16.25–19.00
1/2-in.—	36.00– 45.00	19.00–22.75	17.75–21.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3% to 3.1%	2% to 5.1%
2500 to 5000 lb.	+1% to 8.1%	4% to 10.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $8.75
1/5 to std. pkg.	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$8.00
1/5 to std. pkg.	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$28.06–$35.01
Coil to 1000 ft	25.26– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$21.00–$32.00
Coil to 1000	21.00– 23.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00

Standard pkg., 2200. List per 1000, $20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–17%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.49
No. 18, full spools	.48

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.54 to $0.57
No. 18, full spools	.48 to .52

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.00	$11.50	$10.00
12	20.34	20.34	15.25
10	27.72	27.72	18.48
8	38.52	32.10	25.68
6	61.02	45.78	40.68

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22.00	$12.00	$12.00
12	27.00	18.00	18.00
10	39.62	39.62	33.96
8	55.37	47.46	47.46
6	63.54	63.84	53.20

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$31.00
25 to 50 lb	31.00
50 to 100 lb	30.00

CHICAGO

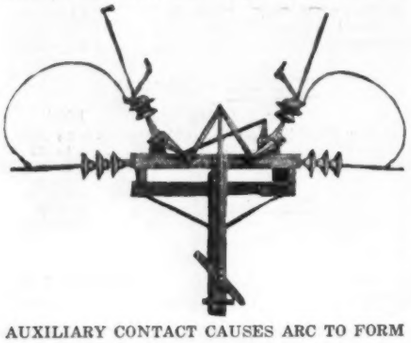
	Per 100 Lb. Net
Less than 25 lb	$30.75
25 to 50 lb	30.75
50 to 100 lb	30.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Air-Break Switch with Auxiliary Contact

By rupturing the circuit at its tip when opening the auxiliary or arcing contact of the type "T" air-break switch recently developed and placed



AUXILIARY CONTACT CAUSES ARC TO FORM PARALLEL TO LINE WIRE

upon the market by the George Cutter Company, South Bend, Ind., blistering of the main contacts is completely prevented. The arc is drawn at a point some distance above the grounded framework in a vertical plane parallel to the line circuit and thus prevents shortening of phase spacing in opening and insures prompt interruption of the current. The main contact is of the spring type, consisting of a multiplicity of parallel spring wires, each sealing in a "V" notch in the other member of the contact and arranged to be bent back when in the closed position so as to exert a pressure against the notch. This insures a constant large carrying capacity of each one of the wires. It is claimed that this contact will give satisfactory service under icy conditions and will not weld electrically and prevent opening. Good seating is assured by a wiping action.

The 22,000-volt to 33,000-volt switches of this type have a phase of spacing of 6 ft. (1.8 m.) and in opening stretch the arc to 6 ft. (1.8 m.) length, while the 44,000, 55,000 and 66,000-volt switches have phase spacings of from 12 ft. to 15 ft. (3.6 m. to 4.5 m.) and will stretch the arc in opening from 14 ft. to 17 ft. (4.3 m. to 5.5 m.).

On all of these switches for voltages of from 22,000 to 66,000 standard pin-type insulators with ¾-in (19-mm.) separable thimbles are used, and the insulator caps are held on by rings under which set screws in the cap are engaged, forcing the cap down rigidly on the top of the petticoat of the insulator. The set screws exert no direct pressure against the porcelain.

The switch shown herewith is hand-operated, but it can be equipped with an automatic overload release and operating mechanism if desired.

All-Steel Transformer Casing

Weighing only one-third as much as the former cast-iron transformer case, the steel-case transformer just placed upon the market by the Adams-Bagnall Electric Company of Cleveland, Ohio, is said to have several improvements over the old type. The channel construction gives it maximum strength, and it is more durable on account of a steel rim, steel lugs for hangers, a steel base and a drain pipe welded to the base which enables the tank to be completely drained. No brazing

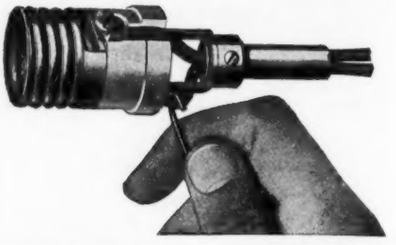
ALL-STEEL CASE WEIGHS ONLY ONE-THIRD THAT OF CAST-IRON CASE

is used in its manufacture as all joints are welded. Its decreased weight has the advantage of less shipping charge, ease of handling when mounting on line poles and less stress on the poles when mounted.

This style of case is used with transformers of this company ranging in size from 25 kva. to 75 kva. and voltages up to 4000.

Easily Wired Keyless Candle Socket

In the improved keyless candle socket now made by the Bryant Electric Company of Bridgeport, Conn., there is a hole in the center contact of approximately the same diameter as the inside diameter of the tubing which is generally used for making the stems on which to mount the sockets. The socket is dropped down over the wires, as they protrude from the stem, and the socket is screwed in place—this operation being possible without twisting the wires or damaging them in any way. After the socket has been firmly attached the wires are pulled back by

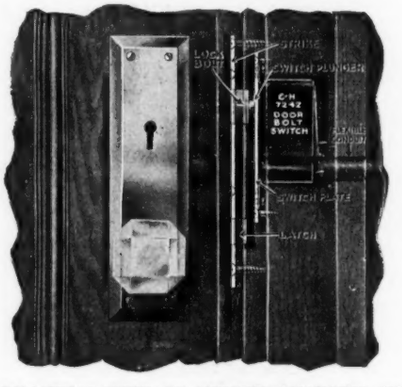


WIRES DO NOT HAVE TO BE TWISTED WHEN BEING INSERTED IN SOCKET

means of a hook or any convenient tool through the open yoke or "hickey" which forms a part of the socket and are led through the grooves in the porcelain to the binding screw terminals.

Door-Bolt Switch for Hotel Lights

To prevent the wasteful use of electric lights in guest rooms, hotels and clubs often display in each room a sign reading "Please turn out the lights when leaving the room," but even this is not always an assurance that the switch will be operated. However, by the use of a door-bolt switch just developed and placed upon the market by the Cutler-Hammer Manufacturing



PHANTOM VIEW OF SWITCH MOUNTED IN DOOR JAMB

Company of Milwaukee, Wis., when the occupant of a room leaves and locks the door from the corridor side the lights within the room are disconnected from the circuit and the wall switch is

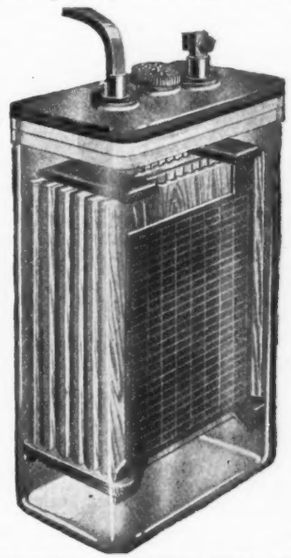
made inoperative. When the door is unlocked the wall switch may be used to control the lights.

This switch is operated by the lock bolt of a two-bolt lock such as is generally used in hotels. It is mortised in the lock side of the door jamb in back of either a flat or box strike, and is connected in series with the regular wall switch which controls the lights within the room. As it is customary to install the regular wall switch conveniently near the door, very little additional wiring is necessary for the installation of the door-bolt switch. The accompanying illustration shows the details of the new device and how the movement of the lock bolt will push against the switch plunger and thus open the switch.

Farm-Lighting Battery with Cover Suspension

By suspending the elements directly from the cover the Prest-O-Lite Company, Inc., Forty-second Street Building, New York City, has produced and is marketing a battery in which short circuits are eliminated. The manufacturer claims that the cover is fully capable of sustaining the weight of the elements without the necessity of the wooden strips sometimes placed under the upper lock nuts and resting upon the edges of the jar. One of the main points gained by the elimination of bridge supports, according to the makers, is that the separators extend beyond the bottoms of the plates, thus eliminating the possibility of growths and resultant short circuits at the place where growths are liable to occur.

The extension lug extends beyond the outside plate line only in the outside negative plates, and there would be



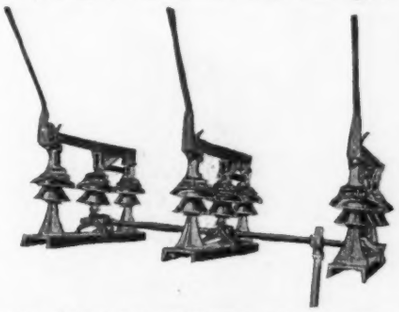
ELEMENTS SUSPENDED FROM COVER

no possibility of contact with the positive plate even if sediment were deposited on the separator supports.

The elements of these batteries are inclosed in a glass jar of uniform thickness which is not likely to break. In addition, the resiliency of the separator supports precludes shocks to the jar when the battery is moved. A heated knife is all that is necessary to cut the sealing compound and remove the cover of the battery for cleaning, etc., and the sealing compound does not need to be replaced.

Vertical-Break Type Disconnecting Switch

There is no rotative force on the insulators of the vertical-break pole-top disconnecting switch now being manufactured by the Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, as they are either in direct tension or compression. This is claimed to be an ideal way of using a built-up porcelain insulator since it eliminates any torsional strain between different shells. These switches are operated by a series of levers of simple construction. During the initial period of the opening operation, when the blade is being driven off the contacts, the mechanism works upon a very long leverage. This exerts a pow-



HORIZONTALLY MOUNTED SWITCH WITH VERTICAL BREAK

erful force at this stage in the opening. Just as the blade leaves the chip block it comes in contact with an arcing horn which eliminates any possibility of burning the clip block. As the blade moves upward it draws away from the arcing horn faster and faster as the effective lever arm is shortened; consequently the breaking up of the arc is rapid and smooth. During the opening and closing operation the blades always operate in the same plane as the line wire which prevents phases from coming too close to each other.

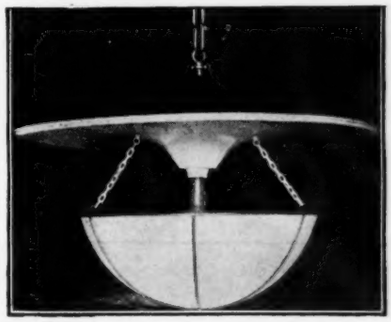
Utility Motor for Farm-Lighting Plant

Operating on a 32-volt circuit, the type UM-D utility motor manufactured by the Dyneto Electric Corporation, Syracuse, N. Y., is said to be light in weight and not likely to get out of order. Four pulley sizes are furnished as standard equipment with this motor, which is mounted on a tripod base. For ordinary purposes this stand is of sufficient rigidity, but if the total ¼ hp. of the motor is used, a weight will have to be hung from the hook under the base plate. The base of the motor is slotted so that the legs can be removed and the motor mounted as desired.

The completely inclosed construction protects fingers and insures safety of operating parts in wet or dirty locations.

Commercial Semi-Indirect Lighting Unit

For installation where the ceilings are dark, discolored, broken up by pipes or beams or otherwise non-conducive to



STEEL PAN DIRECTS RAYS OF LIGHT DOWNWARD OVER LARGE AREA

the best results from semi-indirect lighting fixtures, Bayley & Sons, Inc., of 101 Park Avenue, New York, have developed a semi-indirect lighting unit known as No. 4040. It is equipped with a glazed steel pan finished in dull white enamel and placed above the milky-white glass bowl so that the light rays are properly directed downward without halation or glare. The unit gives a wide and even distribution and uses gas-filled lamps, being adapted for use in stores, offices and other commercial installations.

NOTES ON RECENT APPLIANCES

Battery Charger for Small Garages

The General Electric Company of Schenectady, N. Y., has just placed on the market a "Four-Battery" Tungar battery charger designed to meet the needs of the garage of automobile dealers' establishments where it is desired to do a small amount of storage-battery charging.

Electrically Operated Washing Machine

The Coffield Motor Washer Company of Dayton, Ohio, has developed its 1920 model electric washer, which has several improvements over the previous type.

Farm Lighting and Power Plant

The Acme Engineering Company of Louisville, Ky., is marketing the "Farm-O-Lite," a sixty-light farm lighting and power plant.

Manufacturers' Activities

CLOSES BIG REFRIGERATION CONTRACT.—The Michigan Light & Consumers' Power Company, with headquarters at Jackson, Mich., and operating extensively throughout the southern, western and northern parts of the state, has closed a contract with the Kelvinator Corporation, 921 West Fort Street, Detroit, whereby it will handle and install the Kelvinator domestic refrigerating unit in Jackson, Battle Creek, Kalamazoo, Grand Rapids, Muskegon, Saginaw, Owosso, Pontiac, Manistee and Cadillac.

SUCTION SWEEPER SALES SCHOOL.—To insure the highest degree of efficiency in marketing its product, the Hoover Suction Sweeper Company is operating a sales school at its plant at North Canton, Ohio. The plan of the school is to acquaint the entire Hoover sales organization with factory methods and service plans. The school is under the direction of Earl C. Marine, who was formerly associated with the sales school of the National Cash Register Company. The illustration shows a number of the Hoover company's sales managers and salesmen who gathered at North Canton to take the course.

SALES SCHOOL OF THE HOOVER SUCTION SWEEPER COMPANY, NORTH CANTON, OHIO

FOREIGN TRADE CONVENTION.—Preparations for the seventh national foreign trade convention, to be held in San Francisco, May 12-15, 1920, are now actively under way. James A. Farrell, chairman of the National Foreign Trade Council, has appointed a Pacific Coast convention committee of the council, consisting of H. F. Alexander, Tacoma; J. K. Armsby, Robert Dollar, Frederick J. Koster, San Francisco; J. J. Donovan, Bellingham; M. H. Houser, Portland, and William Pigott, Seattle. The executive committee will consist of the San Francisco members. Keen interest in the convention is evident among foreign traders even at this early date. Unusually elaborate plans are being perfected to make the occasion a memorable one. The attendance of Americans engaged in business abroad and the entertainment of the wives of the visiting delegates are features to which special attention will be given.

BROKAW-EDEN REPRESENTATIVES HOLD CONFERENCE.—About ninety representatives of the Brokaw-Eden Company inspected the Gillespie Manufacturing Company's plant at Lowell, Mass., July 18, where facilities are being completed for the intensive production of Eden washers for New England distribution. After visiting the factory the party returned to Boston by special cars and assembled at the Boston Yacht Club for luncheon. In the group were about twenty representatives of the Wetmore-Savage Company, Boston, New England jobbers for the Brokaw-Eden Company. In the afternoon addresses were given by R. T. Mirrick, New York, sales manager Brokaw-Eden Company, on "Factory Organization"; A. A. Magher, president Electric Appliance Company, Pittsburgh, Pa., on "Competition," and H. G. Seaber, vice-president Brokaw-Eden Company, New York and St. Louis, on "Advertising and Sales."

LARGE INDUSTRIAL TRANSFORMER ORDER.—Brooks Faxon, New England representative of the Wagner Electric Manufacturing Company, Boston, reports the early installation of an order of transformers aggregating 4093 kw. at the factory of the Gillette Safety Razor Company, South Boston. The equipment includes four 667-kva. outfits for 13,000-volt to 440-volt service connected with the Boston Edison company's supply and the following transformers for inside service: three 300-kva., three 100-kva. and three 75-kva., apportioned for lighting, power and electric furnace work.

G. E. SALES AT RATE OF $170,000,000 A YEAR.—During the first six months of the current year bookings by the General Electric Company, it is understood, were at the rate roughly of $170,000,000 annually. While this, of course, is considerably less than bookings for 1918, still it must be remembered that bookings for the first quarter were considerably less than for the second quarter, and consequently that the annual rate shown by the first six months of the year may be considerably increased before the year is over. It is also understood that billings are running ahead of last year, owing to the large number of unfilled orders carried over.

J. R. EVANS, who has been accountant of the Fort Wayne (Ind.) Works of the General Electric Company, has been named production manager of that plant.

GEORGE B. ALLAN, Texas representative of the Yarnall-Waring Company, Philadelphia, who has been at 305 Southern Pacific Building, Houston, will hereafter make his headquarters in Dallas.

EMPLOYEES of the Sprague Electric Works of the General Electric Company of Bloomfield, N. J., have taken up the matter of thrift and inaugurated a permanent savings plan through the National Thrift Bond Corporation of New York City.

THE A. C. ELECTRICAL MANUFACTURING COMPANY, Fourth Street and U. B. Building, Dayton, Ohio, which was recently incorporated, with R. Harry Cronenger as president and general manager and V. G. Apple as secretary and treasurer, is turning out a complete line of motorboat lighting systems and also generators, batteries and switchboards for home lighting. The company's product has been manufactured by the Dayton Electrical Company for the past twenty years and has recently been taken over by the A. C. company, which has 10,000 sq.ft. of factory space.

THE DUQUESNE ELECTRIC & MANUFACTURING COMPANY, Pittsburgh, Pa., will increase its capital stock from $50,000 to $150,000.

THE NAUGLE POLE & TIE COMPANY, Chicago, announces the opening of a branch office, in charge of E. L. Morier, at Room 800, 41 Park Row, New York.

G. A. OMAN, Northwest manager for the Pacific States Electric Company, Portland, has resigned, and George Boring has been appointed acting Portland manager.

THE ROSSENDALE - REDDAWAY BELTING & HOSE COMPANY, Newark, N. J., announces the appointment of E. O. Floyd as its general sales manager, to take effect Aug. 1.

THE KAYENN MANUFACTURING COMPANY, Brooklyn, N. Y., manufacturer of electrical goods, has leased a floor in the building at 291 and 293 Adams Street for a new factory.

THE MOTOR PROTECTOR MANUFACTURING COMPANY, 111 Kearny Street, San Francisco, Cal., has succeeded to the business of the Baruch Electric Controller Corporation.

THE DIEHL MANUFACTURING COMPANY, Elizabeth, N. J., announces the appointmnt of H. W. Fells as manager of its New York office, at the Singer Building. The appointment took effect on Aug. 1.

THE APEX APPLIANCE COMPANY is erecting a five-story plant at Thirtieth and Sawyer Streets, Chicago, to cost $275,000. The factory is to stand on a lot measuring 100 ft. by 260 ft. and is to be of reinforced-concrete construction.

THE PORTABLE ELECTRIC SEARCHLIGHT COMPANY, formerly of 87-89 Haverhill Street, Boston, Mass., is now at the plant of the Motor Specialties Company, Waltham, Mass., in order to enjoy better manufacturing facilities.

THE ELECTROMOBILE COMPANY, Boatmen's Bank Building, St. Louis, Mo., announces that the electromobile industrial trucks and tractors which are manufactured exclusively under its license by the Koppel Industrial Car & Equipment Company, are sold through arrangements just completed through the twenty branches of the Fairbanks Company of New York City.

THE WELLMAN-SEAVER-MORGAN COMPANY of Cleveland, Ohio, manufacturer of hoisting engines, hydraulic turbines, mining and other heavy machinery, is offering a block of 7 per cent cumulative preferred stock at par. This company operates extensive plants in Cleveland and Akron and is one of the largest manufacturers in the country of hydraulic turbines. The officers feel that the awakening which is taking place in the United States and Canada as to the possibilities of these machines insures their increased use.

A. P. SAAS, formerly sales manager of the Independent Lamp & Wire Company, Inc., New York City, resigned recently to go into exporting and importing business at 39 Cortlandt Street, New York City. Mr. Saas still holds his connection as secretary-treasurer and a director of the Miniature Incandescent Lamp Corporation, Newark, N. J. A. F. Pusch, formerly of the Capital Electric Company, Denver, Col., succeeds Mr. Saas as sales manager of the Independent Lamp & Wire Company.

THE WAPPLER ELECTRIC COMPANY, INC., 173 East Eighty-seventh Street, New York City, manufacturer of batteries and other electrical equipment, has awarded the contract for the erection of the proposed new three-story reinforced-concrete manufacturing plant. The works will be located on property recently acquired on Harris Avenue, near Queensborough Bridge, Long Island City, and will provide a manufacturing area of about 50,000 sq.ft. Notice was recently filed by the company of an increase in its capitalization from $750,000 to $850,000 to provide for expansion.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, announces the appointment of Thomas O. Morgan, until recently head of the service department of the New York office, to the position of sales engineer. He will handle Long Island and Connecticut territory. H. S. Valentine has been appointed sales engineer in charge of Philadelphia territory. An office has been established in the North American Building, Philadelphia. Mr. Valentine was connected with the Link-Belt Company of Philadelphia for five and one-half years, with the Brown Hoisting Machine Company and Yale & Towne Manufacturing Company for six years and with the Badenhausen Company for one year.

R. C. AGLER, formerly sales engineer with the Queens Borough Gas & Electric Company, has recently been appointed district manager for the Fort Wayne Engineering & Manufacturing Company of Fort Wayne, Ind. The firm's New York office is at 30 Church Street.

THE WESTINGHOUSE AIR BRAKE HOME BUILDING COMPANY, an interest of the Westinghouse Air Brake Company, Wilmerding, Pa., has bought eight and one-half acres of ground in Swissvale, Pa., near its plant, on which to erect homes for employees of the Westinghouse interests.

THE MARCONI WIRELESS TELEGRAPH COMPANY of Canada, Ltd., in its suit in the Exchequer Court Canada, against the Canadian Car & Foundry Company, Ltd., and Emil J. Simon has released and forever discharged Emil J. Simon from and against all claims and demands set forth in the statement of the claims and will not institute any other proceedings against him in respect of the claim.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY has begun an addition to its factory at Plainville, Conn., which will add 33⅓ per cent to the existing floor space. A further enlargement is likely to follow in the near future. An interesting summary of the war work of the company recently appeared in the Hartford *Times*. The company manufactured switchboards for all but the latest class of United States submarines. It also manufactured boards for 1200 merchant vessels of the United States Shipping Board, 100 for radio service on merchant vessels, 320 for submarine chasers, 100 for patrol boats and for fifty mine sweepers, and boards for thirty-two destroyers. Trumbull switchboards formed part of the equipment of the first division of engineers that went to France to operate sawmills, and the company's products were also employed in bases where guns were rebored and assembled. The company was founded twenty years ago by John H. and Henry T. Trumbull, the former being president and the latter treasurer of the concern. Frank T. Wheeler was later taken into the management as vice-president. The General Electric Company recently acquired an interest in the company, as stated in these columns. A four-story addition to the plant, which nearly doubled its productive floor space, was completed in December, 1917, but this additional capacity has now been outgrown.

Foreign Trade Notes

JAPANESE ELECTRICAL BUSINESS IN CHINA.—The Consul-General in Yokohama announces that the Tokio Chamber of Commerce considers the electrical business in China very promising. Supplying motors and electric machinery and instruments, as well as capital required for electrical enterprises, will be profitable work.

ELECTRICAL TRADE WITH MALAYA.—The Far Eastern Division, Bureau of Foreign and Domestic Commerce, announces that the trade in electrical machinery for use in railroading, mines and agriculture in British Malaya might well be investigated with care. The 1917 imports from the United States of electrical and other machinery amounted to $171,000.

GERMAN PORCELAIN INSULATOR CONCERNS COMBINE.—About forty German firms in the ceramic industry, it is reported in the London *Electrical Review*, have combined under he title of the Syndicate of German Electrotechnical Porcelain Works for their mutual protection and their economic interest. All of these concerns, the report states, produce mainly porcelain insulators and insulating material.

BRITISH ELECTRICAL IMPORTERS' ASSOCIATION.—It is reported in the London *Electrician* that the Electrical Importers and Traders' Association has recently been formed and several leading firms have already applied for membership. The object of the association is to combine importers and traders in opposition to the action of British manufacturers for the total prohibition of imports of certain classes of electrical and allied goods. The association will oppose such unreasonable restrictions of trade and will try to secure reasonable facilities for importing and distributing such goods as are required by the public and are not manufactured in England either in sufficient quantities or suitable quality. The association is in full sympathy with legitimate means of fostering home industries and encouraging the handling of British goods, but considers that established importing interests should be fairly treated and is not willing to see the trade given over to a group of manufacturers to the detriment of consumers. The address of the association is 97 Cannon Street, London, E. C. 4. Frank W. Challis is secretary.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representation of manufacturers of small electrical novelties and appliances, including medical and dental apparatus, is desired by a man in Spain (No. 30,054). Correspondence may be in English.

A company in Argentina (No. 30,057) wishes to represent American firms dealing in electrical materials. Correspondence should be in Spanish.

The agency on a commission basis for all of Italy for electrical supplies is desired by a firm in that country (No. 30,058). Correspondence may be in English.

A firm in Switzerland (No. 30,060) wishes to secure the agency for the sale of engines driven by electricity (horizontal 20 hp. to 120 hp.), compressors and cranes. Correspondence may be in English.

The agency is desired by a man in France (No. 30,064) for the sale of electrical material. Correspondence should be in French.

The purchase and agency is desired by a firm in Belgium (No. 30,069) for the sale of electrical appliances, such as switches and sockets. Quotations should be given c. i. f. Antwerp. Correspondence may be in English, but catalogs should be in French if possible.

The agency for the sale of electrical machinery and fittings is desired by a man in England (No. 30,004).

The representative of an English firm (No. 30,042) is in this country and wishes to purchase and to secure the agency for the sale of electrical goods in Siberia.

The representative of an English firm (No. 30,017) is in this country to secure the agencies for the sale of electrical goods.

A street railway company in Spain (No. 30,032) wishes to receive catalogs of materials such as rails, overhead construction and electrical conductors. Correspondence should be in Spanish.

A firm in England (No. 30,040) desires to act as an agent for the sale of electrical equipment. Quotations should be given f.o.b. American port or c. i. f. English port. Payment, cash against documents.

An Italian company (No. 30,043) wishes to form a combination with an American concern manufacturing controllers, steel wheels and entire electrical trucks minus the batteries. Correspondence should be in French or Italian.

A firm in Spain (No. 30,044) desires the exclusive agency for Spain and Portugal for the sale of incandescent lamps, both half-watt and ordinary types, heating appliances, insulating material, such as fiber, mica, varnished cambric, insulating compounds, and telephones and equipment. Correspondence may be in English, but Spanish is preferred.

O. M. Smart, trade commissioner of the United States Bureau of Foreign and Domestic Commerce, has just returned from an extensive investigation of the markets for the sale of American electrical goods in Italy. Mr. Smart will confer with interested firms in room 734, Custom House, New York City, between 10 and 12.30 and 2.30 and 5, daily for the next ten days. Appointments may be made either by letter or by telephoning Broad 794.

A general agency and eventually purchase of all articles for electricity, such as comptometers, generators, motors, switches, commutators, small material such as wires and cables, insulating material for motors and generators, material for electric railways, rolling bridges, telephones and telegraphs, and measuring instruments of precision, are desired by a company in Belgium (No 30,051). Correspondence should be in French. Quotations should be given c. i. f. Antwerp. Payment, cash and credit.

The agency is desired by a man in France (No. 30,064) for the sale of electrical material. Correspondence should be in French.

Trade Publications

CABLEWAYS.—The Blaw-Knox Company of Pittsburgh, Pa., has issued bulletin No. 200, descriptive of Blaw cableways, of the automatic single-rope type.

LIGHTING UNITS.—In an illustrated folder the King Manufacturing Company of St. Joseph, Mo., describes and illustrates its "Rite Lite" in closed-type lighting unit.

ANNUNICATORS.—Edwards & Company, Exterior and 140th Streets, New York City, have issued an illustrated folder descriptive of their gravity-drop electric annunciators.

FARM-LIGHTING PLANT.—A booklet has been issued by the Rural Electric Equipment Company of Canton, Pa., about its "Reeco" slow-speed directly connected farm-lighting plants.

ATTACHMENT PLUGS.—The Mueller Electric Company of 423 High Avenue, Cleveland, Ohio, is distributing a leaflet telling about its No. 4 "Attacho" solderless, screw-connection plugs.

ELECTRIC HOUSEHOLD RANGE.—A three-colored display card advertising its new household-type electric range has been printed by the Simplex Electric Heating Company, 85 Sydney Street, Cambridge, Mass.

TRANSFORMERS.—Bell-ringing transformers, toy transformers and make-and-break spark coils are described in Bulletin No. 53, recently issued by the Empire Transformer Company, 2212 Sedgwick Street, Chicago.

ELECTRIC WASHING MACHINE.—The 1920 model of the Coffield electric washing machine with swinging wringer is the subject of an advance bulletin for dealers prepared by the Coffield Motor Washer Company of Dayton, Ohio.

ELECTRIC FLATIRON.—The new simplex electric iron is shown on an attractive three-colored display card which has recently been prepared for dealers' use by the Simplex Electric Heating Company, 85 Sydney Street, Cambridge, Mass.

AUTOMOBILE LAMPS.—Circular Y-1125-A has been issued by the Edison Lamp Works of the General Electric Company, Harrison, N. J., to list its assortmnts of Edison "Mazda" automobile lamps and to describe its new automobile lamp-stock cabinet.

COMPRESSORS, DRILLS AND VALVE GRINDERS.—The Black & Decker Manufacturing Company, 105-115 South Calvert Street, Baltimore, Md., has issued an attractively printed and illustrated catalog of its electric air compressors, portable electric drills and electrically driven valve grinders.

New Incorporations

THE SUMMERVILLE (GA.) PUBLIC SERVICE COMPANY has been incorporated with a capital stock of $25,000. J. A. Guerin is interested in the company.

THE AMERICAN RIVERS POWER COMPANY of Davenport, Iowa, has been incorporated with a capital stock of $100,000. Allen A. Ellis is president and Andrw L. Chezum is secretary.

THE PORTAGE ELECTRIC CONSTRUCTION COMPANY of Akron, Ohio, has been incorporated with a capital stock of $15,000 by Claude Ralph Madlene, D. C. Weis, Leo T. Helb and others.

THE PARAGON INCANDESCENT LAMP WORKS of New York, N. Y., has been incorporated with a capital stock of $60,000 by N. Favian, F. Alexander and L. T. Levy, 110 Morningside Drive, New York City.

THE BELLEVIEW (FLA.) UTILITIES COMPANY has been chartered with a capital stock of $25,000. The officers are: F. E. Martin, president; John L. Carney, vice-president, and Edward S. French, secretary and treasurer.

THE WEST VIRGINIA LIGHT, HEAT & POWER COMPANY of Sistersville, W. Va., has been incorporated with a capital stock of $75,000 by T. C. Davidson, A. D. Lord, A. B. Cheadle, E. R. Broeck and W. F. Stanley, all of New York, N. Y.

New England States

LIBERTY, ME.—The Liberty Light & Power Company, recently organized, with a capital stock of $5,000, contemplates establishing a plant to supply electricity for lamps and motors in the town of Liberty. H. W. Maitherson is president.

HAVERHILL, MASS.—In reply to the demands of the Essex County Board of Trade that the Merrimac River be deepened so that coal may be carried to Haverhill, Lowell, Lawrence, Mass., and Manchester, N. H., the United States engineers have recommended that a "super-central power station" be erected on the water front of Salem or Beverly and that energy from it be distributed to the above cities. The engineers suggest that the river be used as a source of supply rather than a means of transportation.

NEW BRITAIN, CONN.—In connection with the construction of the new plant of the Hart & Hutchinson Company, Corbin Avenue, contract for which has been awarded, considerable electrical equipment will be required. The new works are estimated to cost about $65,000.

NEW LONDON, CONN. — The Shore Line Electric Railway Company has petitioned the Public Utilities Commission for approval of method of construction of a 33,000-volt transmission line from Hallville to the Noank substation.

PLAINVILLE, CONN. — Contract has been awarded by the Trumbull Electric Company to the Meriden Construction Company, for an addition to its factory.

SOUTHINGTON, CONN.—The Hartford Battery Manufacturing Company has purchased the old Clark Brothers' bolt factory in Milldale, which it will use for the manufacture of storage batteries. F. W. Barhoff is president.

WOONSOCKET, R. I.—Plans have been filed by the Barnard Worsted Company, 92 South Main Street, for the erection of a new boiler plant at its works, to be used in connection with a new dye plant also to be erected. Contract for the work, which is estimated to cost $14,000, has been awarded.

Middle Atlantic States

ALBANY, N. Y.—Plans are under consideration by the Commissioner of Public Works for the installation of ornamental lamp standards on Broadway from Livingston Avenue to the city line.

BINGHAMTON, N. Y.—Plans are under way for an extensive lighting system for the central part of this city. W. Earl Weller, city engineer, was requested to gather data showing the cost of installation and maintenance.

BUFFALO, N. Y.—The Atterbury Motor Car Company, Hertel and Elmwood Avenues, is contemplating two extensions to its plant, to cost about $200,000.

CANANDAIGUA, N. Y.—The Council is considering the construction of an ice plant, to cost about $60,000.

GLENS FALLS, N. Y.—Plans are under consideration for the installation of electrically driven pumps at the South Glens Falls pumping station to replace the steam-drive pumps, which have been in service twenty-five years.

MIDDLETOWN, N. Y.—The Wallkill Transit Company is planning to close down its electric generating plant and secure energy from the Orange County Public Service Company to operate its system. It is proposed to replace the present equipment of the power house with a synchronous motor-generator set. The power-plant equipment, it is understood, is for sale. Willard M. Gould is manager.

NEW YORK, N. Y.—Plans have been prepared by Swift & Company, 32 Tenth Avenue, for the erection of a refrigerating plant on West Fourteenth Street, to cost about $1,000,000.

NEW YORK, N. Y.—Contract has been awarded by the New York Telephone Company to the Caldwell Wingate Company for the erection of a telephone exchange building at Borough Park, to cost about $220,000. McKenzie, Voorhees & Gmelin, 1123 Broadway, are architects.

OSWEGO, N. Y.—The People's Gas & Electric Company has offered to sell its gas and electric systems to the city for $1,250,000. The city is considering a water-power development at Dam No. 6 to supply electricity to light the city and operate the city water-pumping station, for which $345,000 in bonds have been authorized.

PENN YAN, N. Y.—The Yates Electric Light & Power Company is extending its transmission line to Keuka College to furnish electricity for lamps and motors to the residences at Keuka Park and along the road.

WATERTOWN, N. Y.—Plans are being prepared by the Northern New York Utilities, Inc., for the erection of a steel-tower high-tension transmission line from Watertown to Black River, a distance of 7 miles. The cost is estimated between $80,000 and $100,000. H. G. Davis is chief engineer.

PAULSBORO, N. J.—Bids will be received by the Borough Council, Council Chamber, Black Building, Paulsboro, until Aug. 18 for construction of a complete sanitary sewerage system, including pumping station and disposal plant. Plans and specifications may be obtained from Remington & Vosbury, engineers, 601 Market Street, Camden, N. J., upon deposit of $10, of which $5 will be refunded.

FOXBURG, PA.—Arrangements are being made by the Clarion River Power Company for impounding the Clarion River for a distance of 94 miles for the purpose of developing the water power to generate electricity for distribution throughout the entire territory, but chiefly within a radius of 50 miles of Foxburg. The initial installation of the Parker plant will be located very near the intersection of the Clarion and Allegheny Rivers. This plant will be built in steps, the first to include the construction of a dam 70 ft. high, generating plant and transmission lines, developing about 24,000 hp. The second step consists of raising the dam to 145 ft. so that 60,000 hp. may be developed. The third step will finish the Parker project, increasing the output to 160,000 hp. Following the completion of the above plant work will be started immediately on the Clarion Dam and generating station, which will be located, according to the present plans, about 4 miles from Clarion. The total capacity of the two plants will be 350,000 hp. The present plans provide for a total of seventeen plants having a generating capacity of more than 800,000 hp. The officers of the company are: Joseph R. Paull, formerly vice-president of the Bank of Pittsburgh, president; Charles M. Hart, vice-president, and Cyril C. Crick, chief engineer, both of Foxburg.

PITTSBURGH, PA.—Contract has been awarded by the National Casket Company, 470 Jackson Avenue, Long Island City, N. Y., to the Hughes-Foulkrod Company, Commonwealth Building, Philadelphia, Pa., for the construction of a new plant at Reedsdale and Mumford Streets, Pittsburgh, to cost about $200,000.

STEWARTSVILLE, PA. — A meeting will be held soon for the purpose of discussing the sale of approximately $10,000 worth of stock to finance the plan to secure electric lights for the town.

AMCELLE, MD.—Plans are being considered by the American Cellulose & Chemical Manufacturing Company, 681 Fifth Avenue, New York, N. Y., for extensions to its plant at Amcelle, to cost with equipment, about $1,000,000.

BALTIMORE, MD.—Plans are being prepared for the erection of a dormitory and power house for Morgan College, Hillen Road and Arlington Avenue, to cost about $75,000. E. L. Tilton and A. M. Githens, 52 Vanderbilt Avenue, New York, N. Y., are architects.

SEAT PLEASANT, MD.—The installation of a municipal lighting system is under consideration by the Council.

MIDDLETOWN, DEL. — Improvements are being made to the plant of Baker & Company, including the erection of a large building and equipping the plant for electrical operation throughout.

CLARKSBURG, W. VA.—Bids will be received by the Clarksburg Water Board until Aug. 30 for furnishing and installing complete with appurtenances the following pumping equipment: One 4,000,000-gal. daily centrifugal pump, gear-driven from gas engine for a total lift of 350 ft.; one 4,000,000-gal. daily centrifugal pump, gear-driven from a gas engine for a total head of 35 ft.; one 6,000,000-gal. daily centrifugal pump, gear-driven from a condensing steam engine, complete with condensing apparatus for a total head of 350 ft. Plans and specifications may be obtained at the office of Fuller & McClintock, 170 Broadway, New York, N. Y., on and after Aug. 14, upon deposit of $10.

LOGAN, W. VA.—The Logan County Light & Power Company, the Tug River Electric Company, Sprigg, W. Va., and the Kentucky River Power Company, Hazard, Ky., have merged into a company known as the Kentucky & West Virginia Power Company and will maintain offices at Logan. A number of improvements will be made by the new company. Among these will be a new trunk power line from Logan to Williamson.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Aug. 26, Portsmouth, Va., Schedule 4269—3000 Mogul lamp sockets. Various yards, Schedule 4275—single and double-conductor magnet wire. Until Aug. 15, Puget Sound, Wash., Schedule 4273—steel welding wire. Until Aug. 19, Norfolk, Schedule 4283—cable hangers. Applications for proposal blank should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until Aug. 12, for furnishing ten baseline switch boxes, 100 two-strip, 50 four-strip, 15 eight-strip metal terminal boxes, 12 cut-out switch boxes, 18 terminal boxes for submarine cable type 2, and 15 of type 3. Further information may be obtained at the above office.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

North Central States

BUCYRUS, OHIO.—The City Council has decided to discard the arc lamps now in use and install a new street-lighting system, to include ornamental lamps in the business section. It is proposed to erect 114 ornamental standards mounted with lamps of 600 cp. in the business districts; 90 incandescent lamps of 400 cp., 270 lamps of 250 cp., and 21 lamps of 100 cp. are to be erected in other sections of the city. Bids will be received by M. J. Lutz, director of public service, until Aug. 11 on a new ten-year lighting contract, to become effective Dec. 1, 1919.

CINCINNATI, OHIO.—A petition has been filed with the City Council to extend the ornamental lighting system on Race Street from Twelfth Street to McMicken Avenue. A motion for an estimate of the cost of lighting Colerain Avenue from Central Avenue to Mill Creek Bridge with ornamental lamps has been passed.

CLEVELAND, OHIO.—The McElrath Tire & Rubber Company, Union Building, is contemplating the construction of a new factory and power plant on East 131st Street, to cost about $80,000.

CLEVELAND, OHIO.—The new municipal electric light plant has been placed in operation. Bonds are expected to be issued by the city to pay for the building of lines.

SALEM, OHIO.—The capital stock of the Salem Lighting Company has been increased from $150,000 to $225,000.

MAYKING, KY.—The Mayking Coal Company is planning to build a power house.

ELKHART, IND.—At an election held recently bonds to the amount of $60,000 were voted for extensions to the municipal electric light and water plants. The plans include the erection of a new power house and the installation of a two-unit plant, giving a twenty-four-hour service.

HUNTINGTON, IND.—The United Telephone Company is contemplating improvements to its system, costing about $20,000. About $10,000 will be expended for cables.

INDIANAPOLIS, IND.—Bids will be receivd by the Board of Sanitary District of Indianapolis, Ind., until Aug. 21 for pumping machinery and equipment for Division 2 of the sewage disposal plant for the Sanitary District of Indianapolis as follows: (a) Pumping machinery, consisting of three electric motor-driven centrifugal pumping units with a capacity of 25,000,000 gal. daily, and three electric motor-driven centrifugal pumping units with a capacity of 15,000,000 gal. daily; (b) mechanically operated sewage screens having a total capacity of 100,000 gal. daily; (c) electrically operated locomotive crane, complete with bucket and attachments. Separate proposals will be received for each of the three divisions. Proposal blanks, copies of plans, etc., may be obtained at the office of Charles B. Hurd, consulting engineer, Merchants' Bank Building, Indianapolis.

PLYMOUTH, IND.—The capital stock of the Plymouth Electric Light & Power Company has been increased by $20,000.

CHICAGO, ILL.—Plans are being prepared by the Osborn Engineering Company, 2848 Prospect Avenue, Cleveland, Ohio, for the erection of a factory on La Salle Street for the Century Rubber Company, 1346 Rawson Street.

DES MOINES, IOWA.—The Des Moines Electric Company contemplates the erection of 40 miles of 44,000-volt electric transmission line connecting Des Moines, Prairie City, Monroe, Knoxville and Oskaloosa. Substations equipped with transformers will be erected in each town.

APPLETON, WIS.—The Fox River Tractor Company contemplates the erection of a plant, to cost about $200,000.

RACINE, WIS.—The electric light company has filed with the city clerk a new contract for Corinthian lights on the east side of Main Street between Third and Fourth Streets. The new contract is for a five-year period.

MINNEAPOLIS, MINN.—According to the budget figures submitted by A. D. Meeds, city lighting superintendent, $423,244 will be required for lighting the city during the ensuing year, approximately $100,000 more than last year. Of this amount $318,154 is asked for electric lighting.

MINNEAPOLIS, MINN.—The construction of a municipal power plant is under consideration by the waterworks committee of the City Council. F. W. Cappelen, city engineer, estimates that 375 hp. could be generated if electric power plants were built on mill power sites owned by the city along the east bank of the Mississippi River. The city owns five such sites and 75 hp. could be developed at each one. The greater portion of such power would be used for operation of an ice plant, which will cost about $250,000, for which plans are now being prepared by Mr. Cappelen.

KANSAS CITY, MO.—Preparations are being made by the Missouri & Kansas Interurban Railway Company to extend its electric lighting, power and heating service in the towns and farming districts along its railway lines. The proposed extensions include an underground high-tension line for furnishing electricity to farmers and dairymen residing within several miles of its railway. Substations are also to be erected at Adams and at Milburn Place. The company obtains all of its electrical energy from the Kansas City Light & Power Company.

ST. LOUIS, MO.—New equipment, including 500 hp. in boilers, chemical and mineral drying apparatus and conveying equipment, it is understood, will be required by the Mineral Refining & Chemical Corporation, Iron Mountain Railroad and River Des Pères, St. Louis, for an addition to be erected at a cost of about $500,000. A Alayo is general manager.

ST. LOUIS, MO.—Permits have been issued and bids will be asked soon for the erection and equipment of three additional buildings, 300 ft. by 702 ft., for the General Motors Corporation at St. Louis. Two assembling plants, one for the Buick division and the other for the Chevrolet division, will be built at a cost of $808,000 each, and an administration building will be erected between the two assembling plants. W. H. K. Kilpatrick, works engineer at the Buick plant at Flint, will supervise the construction.

PIERRE, S. D.—The Hydroelectric Commission has engaged C. V. Seastone, of Mead & Seastone, engineers, to make a preliminary survey of the Missouri River for the purpose of deciding upon a location for a proposed hydroelectric power plant to generate electricity to be distributed throughout the state.

OMAHA, NEB.—The Kimball Laundry Company has purchased a site on Fifteenth and Jones Street, on which it proposes to erect a laundry, to cost in the neighborhood of $200,000.

HARPER, KAN.—Plans are being prepared by W. B. Rollins & Company, engineers, Railway Exchange, Kansas City, Mo., for improvements to waterworks system, including the installation of pumping equipment, engine, generator and pipe lines, to cost about $35,000.

MANHATTAN, KAN.—Plans have been prepared by the Rocky Ford Light & Power Company for the erection of a new electric light and power plant on the west side of the Blue River, to cost about $500,000. A. J. Groesbeck is manager.

Southern States

CHARLESTON, S. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install mechanical stokers in the local power plant, Specification 4012; also turbo-generator, to cost about $50,000, Specification 4010.

ELBERTON, GA.—At an election to be held Aug. 27 the proposal to issue $15,000 in bonds for extensions to the municipal electric light, water and sewer systems will be submitted to the voters.

LOCUST GROVE, GA.—A. R. Scott of McDonough is considering furnishing electricity to Locust Grove and Stockbridge.

McRAE, GA.—The City Council is planning to erect a 10-ton ice plant with 4-ton refrigerating capacity. A new building will be erected and an additional oil-engine unit, of 200 hp., directly connected to generator, will be installed. Oil engine has been purchased. The cost of the equipment is estimated at about $44,000. W. H. Singleton, care of General Delivery, Atlanta, will prepare plans.

MEMPHIS, TENN.—Plans are being prepared by the Union Motor Car Company for the erection of a building for repair works, to cost, including equipment, about $200,000.

MEMPHIS, TENN.—The city of Memphis is planning to erect an auditorium and market to cover one block square on Main and Pollar Streets, to cost about $750,000. C. O. Pfeil, Union Planters' Bank Building, is architect.

OKLAHOMA CITY, OKLA.—The construction of a power house and laundry is under consideration by the State Board of Affairs. N. T. Harding, Equity Building, Muskogee, is architect.

PERRY, OKLA.—It was voted at a meeting of the City Council that the question of issuing $260,000 bonds to rebuild and equip the electric light plant and wiring system, and also the construction of an additional dam, be placed before the public.

TONKAWA, OKLA.—The Council is considering calling an election to submit to the voters the proposal to issue $117,000 in bonds for extensions to the municipal electric light plant and waterworks system. Johnson & Benham, Firestone Building, Kansas City, Mo., are consulting engineers.

BRECKENRIDGE, TEX.—The local electric light plant, owned by B. Paschall, has been purchased by J. E. Lewis of Dallas and associates. Improvements will be made by the new owners, including the installation of new machinery.

BRYAN, TEX.—At a special meeting of the City Commissioners an agreement was reached whereby the city is to purchase the Bryan power plant from H. T. Lawter & Sons. A bond issue of $75,000 for the purchase and improvement of the plant will be voted on on Aug. 26.

CORPUS CHRISTI, TEX.—The Corpus Christi Railway & Light Company, which owns the local electric light and power plant and street railway system, has been placed in the hands of a receiver. Improvements will be made to the property as soon as the sanction of the court for same has been obtained. C. U. Culbertson of Houston is receiver.

EASTLAND, TEX.—The Eastland Light & Power Company is planning to enlarge its electric generating plant to meet the increasing demands for electricity. The company also contemplates the erection of a system of transmission lines through the oil field.

HOUSTON, TEX.—Sealed bids will be received at the office of the city secretary until 12 o'clock noon, Monday, Aug. 25, for the construction of a central high school building for the city of Houston, the work to be let in four separate contracts, general, heating, plumbing and wiring. Plans and specifications may be had by addressing Sanguinet, Staats & Gottlieb, architects, Carter Building, Houston, and First National Bank Building, Fort Worth, Tex., accompanied by certified check for $50 to guarantee the return of plans.

ORANGE, TEX.—The capital stock of the Orange Ice, Light & Water Company has been increased from $60,000 to $100,000. The company is planning to enlarge its plant and system.

STEPHENVILLE, TEX.—Plans are being prepared by the Department of Architecture, Agriculture and Mechanical College, College Station, for the construction of a power plant at John Tarleton Agricultural College, for which $20,000 is available.

Pacific and Mountain States

MOLSON, WASH.—Steps have been taken by the Community Club, composed of leading citizens of the town, to take over the local electric lighting and water system, owned by Ward Brothers, and extend and improve the system to enable it to furnish adequate service to the town.

MORTON, WASH.—The local electric light plant, owned by F. M. Broadbent, has been purchased by J. P. Haggerty of Tacoma, for $10,000.

BEND, ORE.—T. H. Foley, manager of the Bend Water, Light & Power Company, states that a contract approved but not signed by the state for the use of waters from Tumalo Creek for power purposes and to furnish a new supply for domestic uses for the city of Bend has been sent to the company officials for their consideration.

CHICO, CAL.—Preliminary surveys and estimates of cost of a municipal power plant on Chino Creek, to develop about 3000 hp., are being made. F. S. Robison is city engineer.

SAN DIEGO, CAL.—Bids will be received by N. F. Smith, public works officer, Twelfth Naval District, Timken Building, Los Angeles, in September, for building marine brigade post, including administration building, power house, additional barracks, storage houses, sewer, water and lighting systems, etc., on "Dutch Flats."

SAN FRANCISCO, CAL.—Plans are being prepared for the erection of an asylum on Ocean Avenue for the Pacific Orphanage Asylum, to cost about $500,000. A. H. Jacobs, 110 Sutter Street, is architect.

SAN FRANCISCO, CAL.—Two applications have been filed with the State Water Commission by Lars R. Jorgenson of San Francisco for 275 cu.ft. per second of water from the North Fork Yuba River, 25 cu.ft. per second from the Middle Fork of North Fork, and 50 cu.ft. per second from the North Fork of North Fork Yuba River, tributary of Yuba River, for power purposes. This application provides for 80,000 acre-ft., and the diversion works consist of concrete dam 140 ft. high, 400 ft. long on top and 100 long on bottom, and two main canals 13 and 9 miles long respectively. The cost is estimated at about $4,000,000. The other application asks for 400 cu.ft. per second of the waters of the North Fork Yuba River, tributary of Yuba River, for power purposes. A concrete dam 85 ft. high and 200 ft. long on top and 60 ft. on bottom will be built to divert water into a main conduit 4 miles long. The cost is estimated at about $1,400,000.

MESA, ARIZ.—At an election held recently bonds were voted for extensions to the municipal electric light and water systems.

GREAT FALLS, MONT.—Plans are under consideration for the erection of an elevator on the west side of Missouri River on the "Old Stucco Mill" site, to cost about $250,000, by the State Terminal Elevator, Ulm Street.

Canada

WINNIPEG, MAN.—The Winnipeg River Power Company has started work on the construction of a large hydroelectric power plant at Dubonnet Falls on the Winnipeg River, 75 miles from Winnipeg. The company, which is closely allied with the Winnipeg Electric Railway Company, contemplates not only supplying power to the latter company, but to develop an extensive power business in towns throughout Manitoba. The cost of the plant and transmission system is estimated at between $6,000,000 and $7,000,000.

AMHERST, N. S.—The Canada Electric Company contemplates increasing the output of its power plant.

BOWMANSVILLE, ONT.—The Town Council has adopted a resolution requesting the Hydro-Electric Power Commission of Ontario to make investigations relative to the cost of acquiring and completing the construction of the Toronto & Eastern Railway between Toronto and Bowmansville.

KITCHENER, ONT.—The Canadian Consolidated Rubber Company, 137 King Street, is considering building an addition to its plant at 149 Strange Street, to cost about $1,000,000.

PORT ELGIN, ONT.—Plans, it is reported, have been prepared by the engineers of the Hydro-Electric Commission of Ontario for power development in the municipalities of Huron and Bruce. With the Sangueen development scheme and with that at Eugenia, 10,000 hp. will be availerect a laundry, to cost about $200,000.

(Issued July 15, 1919)

1,310,081. SYSTEM AND APPARATUS FOR THE CONTROL OF ELECTRIC CIRCUIT BREAKERS; William H. Holloway, Denver, Col. App. filed Dec. 7, 1916. Flexible method of controlling circuit breakers singly or simultaneously.

1,310,097. WATER-COOLED TRANSFORMER; Edward D. Tremanor, Pittsfield, Mass. App. filed Sept. 13, 1918. Adaptable.

1,310,109. ELECTRIC-FURNACE-CONTROL APPARATUS; Harry A. Winne, Schenectady, N. Y. App. filed Jan. 2, 1919. Predetermined relation can be made.

1,310,110. ELECTRICAL CUT-OUT; Lionel M. Wolffsohn, Hoboken, N. J. App. filed July 15, 1916. Durable.

1,310,111. CIRCUIT BREAKER OR CUT-OUT; Russell Ancotti, West Springfield, Mass. App. filed Feb. 28, 1917. Prevents arc at break of circuit.

1,310,127. WELDING APPARATUS; Wilbur L. Merrill, Schenectady, N. Y. App. filed Jan. 31, 1919. Adjustable.

1,310,130. METHOD OF PRODUCING METAL TUBES; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Feb. 6, 1919.

1,310,131. ELECTRIC WELDING; Paul O. Noble, Schenectady, N. Y. App. filed May 6, 1918. Current modified.

1,310,135. ELECTRIC SWITCH MECHANISM; Walter Richmond, Memphis, Tenn. App. filed Oct. 24, 1911. Alternating or direct current.

1,310,138. LOCKING PLUG FOR RECEPTACLES AND THE LIKE; Howard R. Sargent, Schenectady, N. Y. App. filed Dec. 6, 1917. Removable only by authorized person.

1,310,149. LIGHTING FIXTURE; Robert C. Stephens, St. Louis, Mo. App. filed Oct. 11, 1915.

1,310,150. LANTERN; Homer A. Wood, Indianapolis, Ind. App. filed Nov. 29, 1915.

1,310,163. INCLOSED SWITCH; Knud Knudsen, Plainville, Conn. App. filed Aug. 22, 1918. Interlocking.

1,310,168. LOCKING SWITCH; Edson O. Sessions, Chicago, Ill. App. filed Sept. 6, 1917. For use under limited space conditions.

1,310,175. FUSE PLUG; Wendell L. Carlson, Jamestown, N. Y. App. filed March 8, 1918.

1,310,178. CONVERTER; Frederick D. Cooley, Detroit, Mich. App. filed July 15, 1918. Prevents injurious arcing.

1,310,182. FUSE PLUG; Charles L. Eidlitz, New York, N. Y. App. filed April 9, 1918. Fusible conductor renewable.

1,310,200. POSITION INDICATOR OR RECORDER; Hudson Maxim, Hopatcong Borough, N. J. App. filed Dec. 15, 1914.

1,310,201. POSITION INDICATOR OR RECORDER; Hudson Maxim, Hopatcong Borough, N. J. App. filed Dec. 29, 1914.

1,310,216. REVERSE-PHASE RELAY; Edmund O. Schweitzer, Chicago, Ill. App. filed Nov. 3, 1913. Need of supervision reduced.

1,310,226. CALL-DISTRIBUTING SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed July 14, 1917.

1,310,269. ELECTROMAGNETIC CONTACTOR; Reuben I. Wright, Wickliff-on-the-Lake, Ohio. App. filed June 28, 1916. Single electromagnetic structure.

1,310,299. CORE FOR ELECTRICAL APPARATUS; Ivanhoe H. Sclater, Pittsfield, Mass. App. filed Nov. 21, 1918. Winding supports provided with lamination.

1,310,318. CONTROLLING DEVICE; Arthur T. Anderson, Champaign, Ill. App. filed March 25, 1919. Automatic release.

1,310,337. APPARATUS FOR EXPOSING CINEMATOGRAPH POSITIVE FILMS; Cecil M. Hepworth, London, Eng. App. filed June 5, 1918.

1,310,341. ELECTRIC FURNACE; Otis Hutchins, Niagara Falls, N. Y. App. filed Nov. 18, 1918. Contamination reduced.

1,310,342. PROCESS OF PURIFYING ALUMINOUS MATERIALS; Otis Hutchins, Niagara Falls, N. Y. App. filed Dec. 5, 1918. Produces high-purity abrasive.

1,310,349. AUTOMOBILE OR TIRE THEFT ALARM; Daniel T. Keenan and Catherine C. Keenan, Philadelphia, Pa. App. filed Nov. 22, 1917.

1,310,353. MAGNETIC STARTING SWITCH; Louis Kovacs, Chicago, Ill. App. filed Sept. 10, 1917.

1,310,354. COMBINATION SWITCH; Louis Kovacs, Chicago, Ill. App. filed Jan. 21, 1918. Secret switch in series.

Record of Electrical Patents

Notes on United States Patents

1,310,361. STATION INDICATOR FOR RAILWAY CARS; Raoul P. Mass, Melbourne, Victoria, Australia. App. filed April 11, 1917.

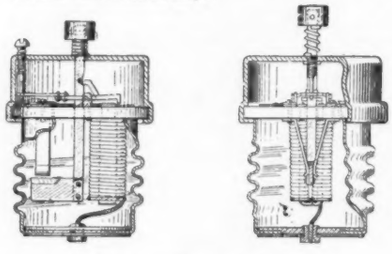
1,310,372. ELECTRIC CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed Sept. 12, 1914.

1,310,373. ELECTRIC CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed Feb. 15, 1915.

1,310,374. ELECTRIC CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed June 21, 1915.

1,310,375. ELECTRIC CLOCK SYSTEM; Arthur F. Poole, Chicago, Ill. App. filed Oct. 24, 1917.

1,310,380. MULTIVALUE OVERLOAD SWITCH; George H. Whittingham, Bancroft Park, Md. App. filed June 17, 1918. Core returns automatically.



1,310,562—Circuit Breaker

1,310,381. UTILIZATION OF TIN SCRAP; Daniel A. Wilcox and Sidney H. Wilcox, Garden City, N. Y. App. filed Oct. 26, 1914.

(Issued July 22, 1919)

1,310,411. METHOD OF RAIL BONDING; Lawrence P. Crecelius, Cleveland, Ohio. App. filed Aug. 31, 1916. Single operation.

1,310,414. ELECTRIC SIGNAL; Wesley H. Geiger, Wormleysburg, Pa. App. filed Jan. 8, 1915.

1,310,418. METHOD OF ELECTRIC WELDING; Charles H. Kicklighter, Atlanta, Ga. App. filed Sept. 21, 1918.

1,310,419. METHOD OF ELECTRIC WELDING METAL PLATES; Charles H. Kicklighter, Atlanta, Ga. App. filed Nov. 27, 1918.

1,310,427. SPARK-PLUG INTENSIFIER; George R. Meissner, Dexter, Iowa. App. filed April 29, 1918.

1,310,430. SWITCH; Clyde M. Nye, Emmett, Idaho. App. filed June 20, 1918.

1,310,443. INSTRUMENT FOR ASCERTAINING THE POINT OF RECALESCENCE OF STEEL; Joseph B. Robinson, Rochester, N. Y. App. filed Jan. 16, 1919. Abutment permits movement of magnet.

1,310,449. ELECTRODEPOSITION OF MAGNESIUM; George P. Seward, Jersey City, N. J. App. filed March 23, 1916.

1,310,450. PROCESS OF ELECTRODEPOSITING MAGNESIUM; George P. Seward, Jersey City, N. J. App. filed Nov. 19, 1917.

1,310,458. ELECTRIC MOTOR SYSTEM; Carl Trettin, Berlin, Germany. App. filed June 5, 1913.

1,310,465. MANUFACTURE OF CALCIUM CARBIDE; Frederick M. Becket, Niagara Falls, N. Y. App. filed Aug. 15, 1917.

1,310,474. ELECTRIC SWITCH; Alexandre Gourju, Villeurbanne, France. App. filed Jan. 14, 1919. Cover takes place of key.

1,310,476. ILLUMINATED WRITING INSTRUMENT; Louis F. Hart, Groton, N. Y. App. filed Oct. 10, 1917.

1,310,485. TIMER FOR INTERNAL-COMBUSTION ENGINES; John J. Lamb, Detroit, Mich. App. filed Oct. 8, 1917.

1,310,496. MAIL BOX; Ernest Hack, Detroit, Mich. App. filed April 18, 1917.

1,310,503. PRESSURE-OPERATED PUMP-CONTROLLING MECHANISM; Adolph Rydquist, Rochester, N. Y. App. filed Dec. 26, 1914. Instantaneous engagement of contacts.

1,310,535. HEAT ELEMENT FOR ENGINE MANIFOLDS; William Kaisling, Chicago, Ill. App. filed June 19, 1913. Self-contained, readily mountable.

1,310,544. OIL-LEVEL INDICATOR AND SIGNALING DEVICE; Arthur J. Routson, Prairie Depot, Ohio. App. filed April 27, 1918.

1,310,554. ELECTRIC WELDING MACHINE; George J. Armstrong, Buffalo, N. Y. App. filed May 16, 1916. Double contact.

1,310,555. ELECTRIC WELDING MACHINE; George J. Armstrong, Buffalo, N. Y. App. filed May 1, 1919. Electrodes mounted on swinging supports.

1,310,562. CIRCUIT BREAKER; Gwyn O. Davies, Cle Elum, Wash. App. filed Feb. 11, 1919. Break in current easily located.

1,310,568. ACOUSTICALLY OPERATED ELECTRIC-CONTACT-ACTUATING MECHANISM AND SYSTEM EMPLOYING THE SAME; Arthur C. Heap, Woking, and Allan B. Field, Marple, England. App. filed April 3, 1919.

1,310,578. MEANS FOR ATTACHING ELECTRICAL APPLIANCES TO CONDUIT OUTLET BOXES; John E. Parker and Daniel B. Winter, Syracuse, N. Y. App. filed July 30, 1915.

1,310,585. HIGH-POTENTIAL SWITCH; George T. Southgate, Brooklyn, N. Y. App. filed Oct. 6, 1917. Minimum number of contact points.

1,310,595. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 22, 1917.

1,310,599. VARIABLE-RESISTANCE REGULATOR FOR ELECTRIC CIRCUITS; William L. Bliss, Niagara Falls, N. Y. App. filed April 17, 1914. Uniform action.

1,310,605. PERMUTATION ELECTRIC SWITCH; Thomas Capparella, New York, N. Y. App. filed Feb. 6, 1919.

1,310,608. RAILWAY SIGNALING; Elmer R. Coe, Wilkinsburg, and Robert M. Gilson, Pittsburgh, Pa. App. filed Aug. 7, 1916.

1,310,622. ELECTRIC RELAY AND MOTOR FOR USE THEREIN; John S. Holliday, Wilkinsburg, Pa. App. filed July 31, 1916. Relay immune to current of predetermined frequency.

1,310,626. RELAY; Lloyd V. Lewis, Edgewood Borough, Pa. App. filed Nov. 17, 1916.

1,310,661. TERMINAL CONNECTOR; John W. Jordan, Philadelphia, Pa. App. filed Oct. 4, 1918. Convenient attachment.

1,310,695. PRIMARY ELECTRIC CELL; Harry E. Evans, Buffalo, N. Y. App. filed Feb. 21, 1918. Internal resistance diminished.

1,310,696. RHEOSTAT; Benjamin F. Gardner, Chicago, Ill. App. filed Sept. 19, 1918. Lamp dimmer.

1,310,714. X-RAY TUBE; Thomas B. Rider, Los Angeles, Cal. App. filed Jan. 18, 1918.

1,310,719. SECRET SIGNALING SYSTEM; Gilbet S. Vernam, Brooklyn, N. Y. App. filed Sept. 13, 1918.

1,310,727. ELECTRODE; Carlo Zorzi, Milan Italy. App. filed June 29, 1918. Plurality of separate elements.

1,310,730. SEMI-MECHANICAL TELEPHONE SYSTEM; William G. Blauvelt, New York, N. Y. App. filed Oct. 12, 1917.

1,310,763. ELECTRIC LIGHTING ASSEMBLY; Albert H. Maranda, Pittsburgh, Pa. App. filed Aug. 10, 1918. No inclosing box needed.

1,310,766. ELECTRICAL SIGNAL FLASHER; Will C. Neahl, Denver, Col. App. filed June 18, 1918.

1,310,778. SPEED-SIGNALING SYSTEM; Frank B. Blakemore, Chicago, Ill. App. filed Oct. 12, 1916.

1,310,779. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed May 21, 1918.

1,310,780. METHOD OF SYNCHRONIZING CLOCKS; James W. Bryce, Binghamton, N. Y. App. filed Nov. 19, 1918.

1,310,781. SYNCHRONOUS CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed June 22, 1918.

1,310,782. SYNCHRONIZING CLOCK SYSTEM; James W. Bryce, Binghamton, N. Y. App. filed Sept. 24, 1918.

1,310,783. SYNCHRONIZING CLOCK; James W. Bryce, Binghamton, N. Y. App. filed Sept. 24, 1918.